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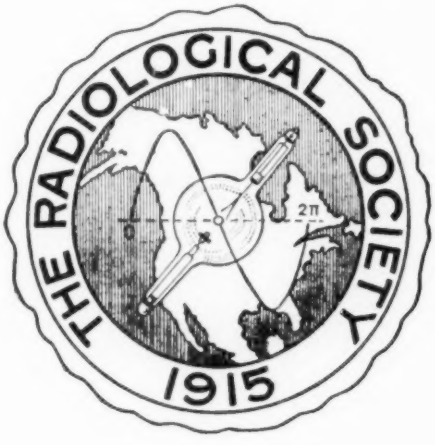

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Present Status of Intensive, High-Voltage Radiation Therapy of Cancer*

LOUIS HERLY, M. D.
New York City.

The idea to treat and cure malignant diseases with x-rays is probably older than is generally assumed. French, English, and American scientists, soon after the discovery made by Roentgen in 1895, attempted to add the x-ray to their therapeutic armamentarium.

Although the first report in the literature referring to treatment of epithelioma of the skin dates from the year 1899, more ambitions attempts were made by Despeignes in 1896 when he made the first effort recorded to treat gastric carcinoma with x-rays. In the same year Voigt reported attempts to treat inoperable carcinoma of the pharynx with the x-ray. In 1897 Gocht used the x-ray in the treatment of inoperable cancer of the breast and reported an amelioration of the pain. Dumstrey in 1897 made an attempt to treat carcinoma of the rectum with x-ray but reported that he observed no effect on the growth intensity of the tumor and that the pain became worse following the treatment. Sjogren and Stenbeck made 30 to 40 exposures of 10 to 15 minutes each and caused complete healing of cancroid of the face and back. But Sjogren advised, in spite of the apparently favorable results in fourteen cases out of twenty-one treated, to operate the carcinoma first and then to use the x-ray to destroy any cells left behind. Up to 1902 the most favorable results were obtained in easily accessible external carcinoma. In 1902 Eijkman reported favorable influence by x-ray in cases of inoperable carcinoma when treatment was combined with vegetarian diet.

All therapeutic attempts made up to this date clearly belong to the purely empirical field. The first important step forward was made by Holzknecht when he perfected his chromo radiometer, the first apparatus made for measuring the quantity of x-rays used in treatment. Other instruments for determining the quantity and quality of the rays applied soon followed and with their use began the era of x-ray therapy based on physical measurements. Around this period, 1902, America (Senn and Pusey) stepped into the field by announcing successful effects with x-rays on deeper lying organs, the spleen and the blood picture, without damage to the overlying skin. This remarkable discovery was soon applied in gynecological diseases, for in the same year R. Crousson reported a case of inoperable cancer of the cervix uteri in a woman of 42 who was apparently cured by treatment with x-rays and ultraviolet rays. These reports were received with great skepticism since such action of the x-rays in the depth without damage to the overlying skin was unknown. However, in 1903, Albers-Schoenberg confirmed these reports by his observations of damage to the sexual glands of animals, without any coincident skin reaction. Similar experimental observations were obtained in the same year by Perthes. Finally in 1903-1901 Heinecke, in an investigation of the ability of x-rays to act in the depth, proved that diseases of certain internal organs could be therapeutically influenced by the rays. With this a foundation had been laid for a further development of deep therapy.

Numerous medical men, physicists and technicians now applied themselves to exploring the new field and to making it practically useful. Holzknecht was the first to combine his own and all the then known results of research into a system, and so created a radiation technique. Of the physicists it was Dessauer in 1904 who was the first to clearly recognize and to undertake an investigation of the various problems of this subject and he also was the first to publish work on the physical question of dosimetry and radiation technique. His conception of sending a homogeneous bundle of x-rays through the human body formed the foundation for further promising results of radiation technique.

In France it was Oudin, Bergonie, Beclere, Belot, Sabouraud, Aubertin and Beaugard, Regaud and Nogier, Barjon, and others who must be ranked in first place among those who helped develop this subject. Beclare transplanted to France the Holzknecht and Kienboeck system of dosage. In England, Morton, Sequeira and Hall, and Edwards led the field. Scandinavia is represented by Stenbeck, Sjorgen, Sederholm and Goesta Forssell. In America the names of Senn, Pusey, Coley, Williams, Pfahler, Beck and Stelwagon stand in the foreground. All of these scientists were at work to create a successful method of deep therapy and to perfect the technical apparatus. In spite of some brilliant successes the majority of reports were of failures and so it seemed as if the development of deep x-ray therapy were about to come to a stop.

Just then the gynecologists stepped into the field. Proceeding from the observation that the human sex glands, especially the ovaries, were found to be especially radiosensitive, they attempted to influence therapeutically, by means of the x-rays, the diseases resulting from pathological conditions of the ovaries. Based on the observations of Halberstaedter on ovaries, first rayed and later

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removed, the opinion gained ground that the x-rays exerted an elective action on these organs. It was shown that the epithelium of the Graafian follicles desquamated and that later the ovum itself degenerated. The stroma of the ovary is affected only when the treatment is protracted. Considering the close relationship between the ovary and the uterus it was at once assumed that the x-rays would constitute an important therapeutic means in the field of gynecology.

In this manner there grew up a formidable competitor of surgery in these gynecological conditions—radiation therapy. The primary mortality of operative treatment, still three to four per cent, was reduced to zero per cent by x-ray treatment. This work was begun in 1910 and the increasing number of publications on the subject revealed the great interest the subject had aroused. Meanwhile the technique was constantly improved, especially by improvements of the x-ray machines and tubes and the development of filtration which allowed for a more perfect radiation dosage. A further endeavor was made to reduce the time of treatment which still stretched over several months.

In that period other practical successes were reported. Inoperable cancers of the breast and inoperable sarcomas were reported primarily cured and free from recurrence at the time. Still there existed an atmosphere of disappointment since the number of failures in malignant conditions by far exceeded a few sporadic successes. However, the intrepid adherents of radiation therapy were seeking other fields of application and succeeded rather unexpectedly in tuberculosis of the skin, mucous membranes, glands, and later in the joints and bones.

Development of Modern Technique.

Based upon their experimental studies, Kroenig and Gauss became convinced that x-rays, more strongly filtered and of harder quality than heretofore used, would cause complete and permanent regression of deep-lying carcinoma, without causing any secondary damage. Judging from their histological studies they believed that there was no fundamental difference in the biological effects produced by the x-rays or the radiation of radium.

Seitz and Wintz also joined the forces treating gynecological cancer by a combination of x-rays and radium. Experience taught them that radium treatment could not be used over indefinite periods of time because of the danger of ulceration and consequent perforation into neighboring organs. Therefore radium was used to destroy the local tumor, and the x-rays for the more distant cancer cell-nests.

In order to escape the danger of a cumulative dose Warnekros proposed to allow the action of both x-rays and radium to take place simultaneously. Because of the inability of radium to act at any greater depth, he did not use radium alone.

Opitz recognized in the simultaneous radium and x-ray treatment the additional advantages of being able to measure simultaneously both the radium rays and the x-rays. Next to the radium container a small ionization chamber can be introduced into the vagina and so the total dose can be measured on an electrometer.

Besides these advocates of the combined therapy, radium and x-ray, there are others like Kehrer, Weinbrenner, Doederlein, v. Seuffert, J. Heyman, H. C. Bailey, etc., who treat the uterine carcinoma with radium alone.

It is evident that in spite of the claims of superior results with intense, high-voltage x-ray therapy, even the pioneers in this field, as well as their disciples, are not content with x-ray treatment alone but depend on radium to destroy the local neoplasm.

At first it was believed that the radium and x-rays exert an elective action on the cancer cell, in the same sense that only the cancer cell is destroyed, while the normal tissues remain uninfluenced. This view soon had to give place to a better understanding for such an elective action has, up to date, not been proved to be the quality of any form of rays. It seems that in their action on organic tissues the rays possess a certain range of intensity within which they are able to influence all varieties of tissue. So that while a certain ray intensity may destroy carcinomatous tissue this intensity is just sufficient to stimulate the neighboring normal tissues to proliferation and scar formation to take the place of the destroyed carcinomatous masses. If this ray intensity is diminished then the carcinoma continues to proliferate, and some believe is stimulated to grow even more rapidly. *If this ray intensity is exceeded then the normal tissues in the neighborhood of the carcinoma are destroyed.* Aschoff, Kroenig and Gauss reported a case of mammary carcinoma that had been given an excessive dose of x-rays, at the autopsy of which were found gangrenous intercostal muscles as well as gangrene of the superficial layers of the lung and small districts of the liver.

That dose which is just sufficient to bring about the destruction of the cancer cell was called the "minimal carcinoma dose" by *Kroenig and Gauss.*

Just as does the carcinoma, the skin and every other tissue of the body is supposed to have its "minimal dose." The relation between the "minimal dose" of the skin, its "erythema dose," and that of the carcinoma cells is called the "Electivity Quotient". This indicates the relation of the radiosensitiveness of the tumor cell to that of the skin.

The manner in which the x-rays affect the carcinoma and the other body tissues has been carefully studied by Aschoff and Waetgen and more lately by F. C. Wood and also by F. Prime. These authors made numerous histological examinations to determine how x-ray and radium rays affect the cancer cells. They came to the conclusion that the primary effect is a damage to the cancer cell and that, secondarily, there follow changes in the connective tissue, and other cells. A vital difference in the changes in the cell that was rayed with x-rays and in the one that was rayed with radium could not be observed. The different phases in cell damage are as follows: Swelling of the cell, hyperchromatosis, giantism of the nuclei, vacuolization of the cell plasma, also partly of the nuclear substance. Physiological products showed keratin and mucus; atypical products showed colloid and hyalin. Degenerative changes: Simple necroses and a breaking up of the dead cell material into amorphous masses are evident and give the appearance of a foreign body within the framework of the tissue. Then follow the stroma reaction and the transformation of the cancer masses into scar tissue. These are considered to be not only the result of the raying but also, partly, the result of toxic irritation exerted by the dying cancer tissue in its surroundings. The reactions are more or less stormy according to the form of the cancer treated. In chorio-epithelioma Aschoff observed the development on the edges of the dead mass of a sort of granulation tissue, while in other forms of malignant disease there were signs of exudative and proliferative inflammation. These consisted in enormous flooding of the inflamed cancer district with eosinophile leukocytes, an edematous swelling of the connective tissue and the vessel walls, proliferation of connective

tissue cells with a coincident new growth of capillaries or an enormous dilatation of the existing capillary system.

According to G. Klein and H. Duerck, immediately after radiation stormy tissue phenomena are released over large areas, the epithelium becoming still further modified. The badly damaged cells form substances chemically different, release a lively chemotaxis and an intensive phagocytosis in the individual necrobiotic cells. The field is filled with the activity of derivatives of fixed tissue cells that have become mobilized and large masses of emigrated hematogenous cells.

Even if it was thought that we could prove, on the basis of biological studies and histological observations, that the x-rays exert a destructive influence on the cancer cells, it still remains to be determined how large the dose of rays must be to positively destroy the cancer cells. Only an exact measurement of the rays at the cancer focus itself could determine this. Kroenig and Friedrich who had previously determined an "ovarian dose" for benign uterine conditions now came into the field with a "carcinoma dose." Since the measuring methods employed until then in x-ray therapy—Sabouraud-Noire-pastilles, Kienboeck-strips and also the intensimeter of Fuerstenau—could not be employed for an exact measurement at the cancer focus itself, Kroenig and Friedrich introduced their "iontoquantimeter," an instrument modified from the original of Scillard.

This iontoquantimeter consists of an electrometer system and a special ionization chamber, which is connected to the measuring instrument with a cable and is so small that it can be introduced into the rectum as well as into the vagina. Enclosed in this ionization chamber are two electrodes separated by an air space, which are in conductive connection with the wall of the measuring instrument and with the electrometer system. When x-rays are admitted into this chamber, then the air space between the two electrodes is ionized and the electricity, with which the measuring instrument has been previously charged now passes between the two electrodes. The quantity of electricity moving between the two electrodes is now measured by the electrometer system which has been set up away from the source of the rays and protected against the influence of rays. An indicator is set into motion. The time elapsing while the indicator traverses a measured distance is directly dependent upon the intensity of the x-rays contained in the ionization chamber. To eliminate dispersion within the ionization chamber Friedrich modified Scillard's aluminum chamber to one of horn coated with graphite on the inside. The graphite coating itself is grounded. Kroenig and Friedrich also have standardized their instrument according to electrostatic units and have designed them with "e," after Kohlrausch. With this instrument Kroenig and Friedrich did their first measurements on cases of breast cancer and determined the "carcinoma dose" at 170 "e," necessitating 40 discharges as against 50 for the skin; thus giving four-fifths of an erythema dose, corresponding to 80 per cent of an assumed 100 per cent surface dose.

About a year later Seitz and Wintz published their work on the "carcinoma dose," which attracted much attention and by many was considered epoch-making. While Kroenig and Friedrich had determined a "carcinoma dose" only in carcinoma of the breast, Seitz and Wintz determined it not only in superficial carcinomas but also in the cervical cancer, that is deep-lying cancer. For their measurements they also employed an improved iontoquantimeter using the skin reaction as the biological measure. The basis of their so-called "biological measuring system" was the "skin-unit-dose." This was obtained by means of a practically homogeneous ray bundle, produced on their machines and with their equipment, using a 0.5 mm. zinc filter, 23 cm. focal distance and 160 to 180 kv. When under these conditions 35 sector-units of their iontoquantimeter are traversed, the skin will show within eight to ten days a slight reddening and after four to six weeks a distinct tanning. This "skin-unit-dose," so obtained, is assumed equivalent to 100 per cent and the dose applied to any deeper lying organ is brought into a percentage relationship to this "skin-unit-dose." So, for instance, the dose necessary to bring about a cessation of menses ("castration-dose") Seitz and Wintz calculate as 34 per cent of the "skin-unit-dose." Their "carcinoma dose" consists of 100 per cent to 110 per cent of this "skin-unit-dose." The "minimal carcinoma dose" according to these authors is 90 per cent, and should not be employed in cases where it is impossible to obtain the dose of 110 per cent. Therefore the carcinoma cell has to be influenced by a slightly higher dosage than is necessary to obtain the skin erythema under the above described conditions. To increase the dosage delivered at the target in the depth (the carcinoma focus) several factors must be taken into consideration; such as, concentration of the ray bundle, large portal of entry, and corresponding increase in the focal distance. Through every entrance portal they were able to deliver into the depth about 20 per cent to 25 per cent of the surface dose so that 5 to 6 skin fields sufficed to deliver their "carcinoma dose" into the depth. Contrary to the method employed at the Freiburg clinic, the Erlangen clinic measures purely by time, after previously standardizing the x-ray apparatus and x-ray tube. Every carcinoma case must receive the full "carcinoma dose" and according to Seitz and Wintz the actual delivery of this can be considered proved when a bimanual examination as well as visual evidence show after an interval of several weeks that the tumor has completely disappeared. All cases are controlled by microscopic examination of excised tumor material (biopsy). According to these authors when a carcinoma does not receive a full "carcinoma dose" a stimulation results as shown by more rapid local growth and metastases. This "stimulating dose" they estimate at from 35 per cent to 40 per cent of the skin-unit-dose. In treating carcinoma, a cumulative dose is also considered dangerous by Seitz. The full dose should, whenever possible, be given in a single sitting. If the carcinoma involves both parametria, two or three sittings are necessary and a full dose must be given at each. In such cases, Seitz and Wintz recommend to ray first the primary tumor and after six to eight weeks one parametrium and after a similar interval the other parametrium. The entrance fields used are about six by eight centimeters.

It is a striking fact that the dose established for breast cancer by Kroenig and Friedrich and the one calculated by Seitz and Wintz for breast cancer and uterine cancer do not agree. According to Kroenig and Friedrich the "carcinoma dose" is 80 per cent of their erythema dose and the Seitz and Wintz "carcinoma dose" is 100 per cent to 110 per cent of their skin-unit-dose. Therefore the latter dose seems to be 20 per cent to 30 per cent higher than the former. Wintz bases his explanation of this divergence on the difference between the Freiburg "skin erythema dose" and the Erlangen "skin-unit-dose" and also on the difference in the measuring apparatus used in the two clinics.

If it is possible to determine an accurate "carcinoma dose" then errors of overdosing and underdosing can be avoided. For some claim that underdosing results in a "stimulative dose" and everybody agrees that an overdose may damage the healthy tissues making further treatment impossible for a long period of time and may even lead to death as the result of damage to vital organs. Indeed such cases are on record (perforation of intestines seen by writer in Frankfurt and a case recently reported in *Surgery, Gynecology and Obstetrics*, of injury to the adrenals). Seitz observed a damage to the rectum with a skin-unit-dose of 135 per cent. Damage to the lymph and blood apparatus lies in the neighborhood of this figure and the lethal dose for striped musculature is around 180 per cent. Seitz and Wintz calculate the "sarcoma dose" at 60 per cent to 70 per cent of their skin-unit-dose.

The leading viewpoint today on the treatment of tumors consists in the radical operation with a thorough clean-up of the regional glands and the subsequent destruction of tumor cells left behind in the tissues and lymph-channels by means of the x-ray. This necessitates the assumption that x-rays destroy the cancer cells. If we view the results obtained by this procedure in the treatment of tumors we must confess that they are not satisfactory.

Kroenig in a statistic garnered from the leading German clinics showed that an average of only 15 per cent of absolute cures was attained by operative treatment of surgical neoplastic diseases. He then recommended that operable tumors also should be submitted to radiation therapy. After a five year period of observation by Bumm and Schaefer of operable and border-line cases of cancer of the crexiv uteri they published the figures of 48.6 per cent cures by operation and 25 per cent cures by radiation therapy. Even the results of prophylactic postoperative raying as reported by Perthes, Lobenhofer and Tichy seem to show more damage than curative value. The following results were obtained by Perthes, one of the earliest advocates of radiation therapy:

Eighty-eight breast cancer cases.

Erlangen apparatus and technique.

Received 5 sessions with each four-weekly interval.

Each sitting, 3 fields.

Breast, axilla and supraclavicular space rayed.

Repetition 3 months after last session.

Further raying every 3 or 6 months.

Filter, 3 mm. aluminum or aluminum-zinc.

Dose, 2/3 to full dose.

Recurrence in First Year Following Operation.

	I Cases not Rayed	II Rayed once Insufficiently	III Rayed Several Times	IV Intensely Rayed Cases
Number of Cases	130	70	74	72
Recurrences in First Year	28% (37)	38.5% (27)	37.5% (28)	41% (30)
Metastases without local Recurrence	11% (14)	38 % (8)	14 % (10)	18% (13)

Perthes concludes that "the power of resistance of the entire organism plays as important a part as does the normal tissue immediately around the tumor cells. When these protective forces are diminished by a *too intensive and too extended raying* and when the roentgen cachexia, so-called by Kroenig, develops, then we observe in place of the attempted cure of cancer a striking proliferation of cancer cells. This is a distinct hint that in roentgen therapy consideration of the general organism cannot be disregarded." (Italics present author's).

Juengling, one of the leaders in roentgen therapy in Germany, says:

"In reference to the practical results we share the position of Tietze and that of the Leipzig clinic. The question: May the prophylactic raying be omitted in the interest of the patient in the majority of surgical carcinomata, in turn, raises the question: May the prophylactic raying in the interest of the patient be employed at all? In general we should say no in answer to this question. The prophylactic raying is still in a completely experimental stage, not even its theoretical basis is firmly established, much less the technique. The prophylactic raying can become a general method of treatment only, then, when a theoretically well established method will give the same good results in the hands of many observers.

"With sarcomata we occupy the position that with the exception of the operable sarcoma of the jaw and the resectable myelogenous sarcomata, all others should be rayed at the present time. If no curative result is obtained then an attempt should be made with operation. In these roentgen-refractory cases we do not hope to attain anything with prophylactic postoperative raying."

And also, "When we consider the results of surgical roentgen therapy, especially in malignant tumors we are attacked by a feeling of hopelessness. Most conceptions of stimulative raying are the result of this feeling. We must experiment in this direction, but we will not give up the foundation built upon the exact researches of many years. Disappointed by the poor results we should not open the door to speculation but we should perfect our methods so that we may be enabled to give the desired dosage with accuracy and certainty. Then, perhaps, in ten years we will be able to pass definite judgment on the optional dose and on the limitations of surgical roentgen therapy."

Tichy observed in operated breast cancer without postoperative raying 11.2 per cent recurrences and in the prophylactically rayed postoperative cases 45 per cent recurrences.

Wertheimer determined in rayed cervical carcinomata an increased metastization into the liver. He found 26 per cent carcinoma metastases in the rayed cases against 11 per cent in the unrayed cases.

Most surgeons believe that the assumption that roentgen radiation will destroy any tumor cells left behind during operation is false. They point to the experimental results in tumor research which show that the action of the Roentgen rays cannot possibly be a directly cell-killing one.

Ewing says: "The reaction of tumor tissue to radiation is extremely variable, due to the complexity of the pathology, therefore from the biological and medical standpoint it is impossible to establish a standard carcinoma or sarcoma dose. Such a conception of a standard dosage seems to emanate mainly from the notion that radiation cures cancer by killing cancer cells; therefore, it is necessary to review the mechanism of the action of these physical agents in causing regression of cancer.

"No cancer cells are killed. Sections taken through tissue that lies superficially and has been 'mildly irradiated,' show hyperchromatism of nuclei and hydropic swelling of the tumor bodies followed by a gradual atrophy of the cells. At the same time the sur-

rounding tissues become active, leukocytes emigrate, lymphocytes and plasma cells appear, capillaries proliferate, and all these invade and replace the tumor mass. A slow regressive process with degeneration of tumor cells, and a progressive process with exudation and proliferation of normal tissues are set going, and as a result of these processes the tumor is cured.

"Superficial lesions 'treated more heavily' show much the same course of events. Some superficial tumor cells may suffer immediate necrosis but tissue sections show that the bulk of the tumor is removed by a very rich exudate of lymphocytes and plasma cells and by active growth of new capillaries which surround and compress much of the deeper parts. In many cases of this type I have failed to find many killed or necrotic cells but have been able to trace all stages of the atrophy of degenerating tumor cells in the mass of reacting proliferating tissue. It is clear that the reaction of the tissue is an essential factor in the curative process.

"When deep bulky tumors are subjected to 'penetrating x-rays' large masses of tumor tissue may be killed, but not by the direct effects of the radiation. Almost always it will be found that the necrosis is due to occlusion of delicate blood-vessels, leading to anemic infarction and secondarily to death of the tumor tissue. Direct killing of deep tumor cells is probably never accomplished by external radiation. It is an important law of pathology that necrosis of tissue cells usually results from failure of the circulation. This law has few exceptions in radiotherapy.

"The most detailed knowledge indicates clearly that the action is not the result of a direct effect exclusively upon the tumor cells, but involves especially a peculiar reaction of the normal or invaded tissues.

"The simple morphological interpretation of the changes reveals the highly important fact that in treating cancer by physical agents we are not merely killing cancer cells but rather are calling upon nature's forces to accomplish the cure."

Keysser proved this to his own satisfaction in mouse tumors. He gave them a double and triple "carcinoma dose" and still the tumors were transplantable. He believes these results to be comparable with human cancer, as the mouse cancers when rayed therapeutically show about the same percentage of clinical cures, namely 30 per cent. The transplantability of the tumor is not stopped, two or three weeks after the raying, even if the tumor almost completely disappears; in this fact Keysser sees the proof that the cancer cell is not directly influenced by the rays.

Ricker believes that the action of the rays consists in influencing the vasomotor nervous system, by means of slowing up the blood stream to a sufficient degree to bring about a necrosis of the carcinoma tissue. According to Ricker, then, only the natural processes are accentuated due to the irritation produced by the rays. The resorption of the parenchyma takes place slowly in association with the increase in cancer tissue. This process can be brought about experimentally as the result of a certain type of circulation of the blood by means of influencing the vasomotor nervous system. *The intensive radiation leads to stasis and destroys parenchyma and stroma. With less intensive radiation only the parenchyma is destroyed and the stroma remains and produces scar tissue.*

Also Fraenkel holds that a primary killing of the cancer cell does not take place as the result of radiation. By means of animal experiments he could prove that the law of Bergonier and Tribondeau is wrong. According to this law "the rays act especially on highly active cells and the influence is the greater the less differentiated the cells are." Drew, however, has shown that, in tissue cultures, cell differentiation and the loss of differentiation can be produced at will. He concluded, therefore, that the loss of differentiation is merely a superficial peculiarity of cancer cells. According to Frankel's experiments the embryonal cell acts in an entirely different way. The cells recuperate and then an inheritance of the new qualities acquired by the rays' action takes place.

It is evident that the German results with the intensive therapy are producing a stage of reaction among their own workers. To add another instance to those quoted above, E. Gnant of Albers-Schoenberg's department in Hamburg reports on their results of postoperative raying in breast cancers. Summarizing their experiences he says, "We must admit that we are far removed from a victory of the x-rays over breast cancer. With the technique of Albers-Schoenberg we have attained a three years' freedom from recurrence in 50 per cent, a figure which is considerably exceeded by the purely operative statistics of most clinics."

The disappointment with the high voltage method is best attested by the supplementary attempts now being made to improve the results. So, Keysser and Lexer are now making an effort at active immunization by injecting into the body, postoperatively, an emulsion of the tumor removed from the patient.

In a recent conversation Perthes told the essayist that "the more intensive the raying the worse were the results." The material at his clinic (Tuebingen) is carefully followed up and arranged according to the method of prophylactic raying employed.

In connection with these observations it is interesting to compare the results of Anschuetz in Kiel, whose statistics are very carefully handled. His intercurrent deaths are all counted as recurrences; all doubtful cases are excluded from his statistics, and the specimen of all operated cases was kept and again examined after five years to avoid any possible mistakes. Yet he reports that of 230 cases of breast cancer, postoperatively rayed with an old apparatus, 60 per cent had a more than five year clinical cure, while of those not rayed prophylactically only 38 per cent had similar good results. The treatment in the clinic of Anschuetz was carried out by Hans Meyer.

Lehman of Rostock, working with his old equipment has better results to his credit in the postoperative raying of breast cancers than those working with the newest high voltage machines giving intensive treatment.

Juengling doing the x-ray work at the clinic of Perthes believes with Henri Hirsch of Hamburg that at each intensive raying of a carcinoma the endocrine systems lying within the field of radiation are damaged, as they are much more radiosensitive than is the carcinoma. For instance, in raying breast cancer we damage the thymus, the thyroid, parathyroid, and occasionally the hypophysis. A case published in this country (Smithies) corroborates this view. In this instance a condition diagnosed as a bone sarcoma was intensively rayed, damaging the adrenals, resulting in an Addisonian state and death of the patient. Subsequent investigation revealed the diagnosis of malignancy to be wrong.

Among the adjuvants used may also be mentioned the copperization of skin and tumor as carried out by Wintz in Erlangen, one of the pioneers of intensive therapy.

Warnekros, in the clinic of Baum, is certain that with radiation alone we cannot cure cancer. We can injure some of the carcinoma cells and kill others, but we leave very many of the cancer cells uninfluenced. Evidently the physical condition of the patient has some bearing on the results. Therefore raising the nutrition of the individual, increasing his power of resistance, mobilizing his protective forms are important adjuvants to radiotherapy. Warnekros as well as Holfelder in the Schmieden Clinic in Frankfurt does this with blood transfusion, preferably from youthful individuals. Warnekros also believes in some special interrelationship between the thymus and cancer, and is attempting to get the cooperation of a biological chemist to isolate the active principle of this gland.

Levy-Dorn also believes that the x-rays influence cancer cells directly though they do not kill them in the sense of a knockout. To obtain this effect something must be added. It probably results from the effect of the rays on the neighboring tissues and perhaps on the organism as a whole by increasing, in a manner not at present understood, the protective forces of the body. This is partly proved by the fact that you may ray one part of the body and have a new growth disappear in another unrayed part. *Intensive raying will damage the connective tissue, which must be regarded as a barrier to the cancer cell, and injury to it opens a breach in the protective wall allowing an invasion of the cancer cells that are left unaffected by the rays.*

Blumenthal and Halberstaedter use, as aids to the protective forces of the body, atoxyl, an arsenic preparation; alival, an iodine preparation; KI and lugol solution, intravenously and into the tumor.

In Bier's clinic a protein therapy is employed to bolster up the x-ray effects. He uses the whole blood of pigs, defibrinated. It is injected around and into the tumor before raying, using from 2 c. c. to 20 c. c. A strong reaction is observed due to necrosis and absorption of the tumor material. Bier advances no theory as to how it acts but he sees the tumor disappear. Of course the good results are only local and he has never seen it cure a case.

All this clearly demonstrates that the hope placed in the high voltage therapy, faced by the damaging evidence, is fast being dispersed.

Other countries though stimulated to great expectations by the earlier German publications of the results obtained by intensive therapy have, generally speaking, not blindly followed these leaders. Forssell in Sweden abhors all fads in science and moves very cautiously and slowly in determining his therapeutic policies. The danger of doing harm to a patient is always in the foreground. The entire cancer material of Sweden is sent to the Radium Hemmett of which Forssell is the director. The state pays the railroad fares of all the poor patients who are sent for either treatment or follow-up observations. Thus he is in an exceptional position to draw conclusions from his material. Forssell has been unable to convince himself of the value and the absence of danger in the use of high voltages in the treatment of cancer. Although his department is equipped with the latest and most powerful apparatus he never gives full erythema doses but rather fractional doses of from one-tenth to, at the most, one-half of an erythema dose at a sitting. A personal observation, during one month, of his methods and results has convinced the essayist that the results are better than those observed in the clinics where intensive high voltage therapy is practiced.

In a recent review of this subject G. Holzknecht states that "the Vienna School accepts some of the German results, while rejecting others and combining the experience gained in the past with modern knowledge.—The question of dosage has remained the centre of our interest.—The conceptions 'destructive dose', 'paralyzing dose', 'stimulating dose', 'carcinoma dose,' 'tuberculosis dose,' etc., have all been found wanting for practical purposes.—In spite of the most phenomenal results obtained in a few cases, *the fact remains that all the technical improvements in the world will not enable us to triumph over the carcinomata absolutely.* It is dignified to acknowledge our inability and to confess that we are confronted by a biological barrier over which to leap is not in our power."

E. Rosenthal of Budapest, who has none of the late apparatus for intensive therapy, reports that the favorable clinical results with his apparatus do not differ from those observed with the newest and best equipment.

In America there has been a short-lived enthusiasm for the high voltage machines induced by the earlier reports from Germany. The enthusiasts have had time to live through some disappointments and the calmer ones have waited for more permanent results before feeling too victorious. W. S. Stone who has had one of the best opportunities to observe the effects on the very large material passing through the Memorial Hospital of New York, says: "***it will be an error to undervalue the therapeutic effects that have already been obtained by the use of the lower voltage machines. With a technique in which distance, filtration and time are increased materially, we await improved results with the old machines." J. Thompson Stevens after carefully reviewing the results of the present radiation therapy goes even further stating that "no case of operable malignancy should escape operation and any case of inoperable malignancy that becomes operable under radiation therapy should likewise be operated."

Finally, I may state that none of the observations and experiences abroad have shaken my belief in the principles laid down and the methods employed by W. H. Meyer in this country.

CONCLUSIONS.

1. A biopsy performed before radiation treatment is without harmful effects.
2. X-rays do not directly kill cancer cells.
3. A standard "carcinoma dose" or "sarcoma dose" of x-rays cannot be established biologically.
4. There is no unimpeachable proof that insufficient raying stimulates tumor growth.
5. Since carcinomas are of different types and degrees of malignancy, not always distinguishable by the microscope, how can the same method of treatment and the same dose produce curative effects in all types?
6. The condition of the organism in general cannot be neglected in seeking indications for x-ray therapy. Undernourished and cachectic individuals are roentgen-refractory.
7. From the evidence at hand there seems to be no reason why the old machines, as commonly used in this country for therapy, with increased distance, filtration and time, will not produce as good results as the high voltage apparatus introduced by the Germans.
8. Intensive, high voltage raying damages the normal tissues. Connective tissue damage breaks down the barriers to cancer cell invasion. Damage to endocrine glands reduces the general resistance of the

patient and by itself even may lead to death.

BIBLIOGRAPHY

Albers-Schoenberg: Muenchen. med. Wchnschr. 50:1859, 1903.

Aschoff, Kroenig and Gauss: Muenchen. med. Wchnschr. 60:337 and 413, 1913.

Aschoff and Waetgen: Deutsche med. Wchnschr. 40:54, 1914.

Bissell: Tr. Obstetrical Soc. New York, 1903.

Borrell and Pankow: Arch. f. Gynaek. 1014.

Borrell: Strahlentherapie, 2:683, 1913.

Bumm, E.: Zentralbl. f. Gynaek. 47:1569, 1912.

Cleveland and Day: Cited in Frommel's Year Book, p. 513, 1905.

Despeignes: Lyon med., 1896.

Dessauer: Med. Klin. No. 21, 1905.

Dessauer and Krueger: Klin. Wchnschr. 15:536, 1908.

Dörn: Muenchen. med. Wchnschr. 56:697, 1909.

Drew: Twenty-first Ann. Report Imperial Can. Research Fund, July, 1923.

Dumstrey: Med. Gesellsch., Leipzig, 1897.

Eijkman: Haarlem, 1902.

Eltze: Winckel's Festsch., 1907.

Ewing: Am. J. Roentgenol. 9:331-336, June, 1922.

Exner: Cited by Gudzent, Radium Therapy, 1919.

Fittig: Beitr. z. klin. Chir. 42: 1904.

Friedrich and Kroenig: Muenchen. med. Wchnschr. 62:1669, 1915; 63:1445, 1916.

Gauss: Muenchen. med. Wchnschr. 58:1528, 1911 and Zentralbl. f. Gynaek. 35:394, 1911.

Gnant: Fortschr. a. d. Geb. d. Roentgenstrahl. 30:326, 1923.

Gocht: Fortschr. a. d. Geb. d. Roentgenstrahl. 1897.

Halberstaedter: Klin. Wchnschr. 43:64-66, 1905.

Heineke: Muenchen. med. Wchnschr. 71:785-927, 1904.

Holzknecht: Wien. med. Wchnschr. No. 53, 1907: Am. J. Roentgenol. 10:476-479, June, 1923.

Juengling: Arch. f. klin. Chir. 116:557, 1921: Verhandl. d. deutsch. Roentgengesellsch. Bd. 13.

Kaestle: Muenchen med. Wchnschr. 58:928, 1911.

Kelen: Monatschr. f. Geburtsh. u. Gynaek. 31: No. 2. 1911.

Keysser: Arch. f. klin. Chir. 117: 97-105, 1921.

Koehler and Herxheimer: Cited in Wetterer's Handbuch, 1919 (p. 440, footnote).

Klein and Duerck: Strahlentherapie, 8:166, 1917.

Kroenig, Gauss, Krinski, Waetgen, Lembcke: Deutsche med. Wchnschr. 40:740 & 793, 1914.

Kroenig and Gauss: Muenchen. med. Wchnschr. 57:1529, 1910; Deutsche med. Wchnschr. 38:940, 1912.

Meyer, W. H.: New York M. J. 106:829, 1917; 111:143, 1920; 112: 936, 1920.

Opitz: Zentralbl. f. Gynaek, 42: 789-792, 1918.

Perthes: Arch. f. klin. Chir. 71: 955, 1903; 74:400, 1904; 116:353-3[illegible], No. 8, 1921; Fortschr. a. d. geb. d. Roentgenstrahl. 8:1904; Zentralbl. f. Chir. 47:25-29, 1920.

Prime: J. Cancer Research, 2:107, 1917.

Rosenthal: Forthschr. a. d. Geb. d. Roentgenstrahl. 30:233, 1923.

Runge: Klin. Wchnschr. 48:2343, 1911.

Seitz and Wintz: Muenchen. med. Wchnschr. 65:89-202-527, 1918; Verhandl. d. Deutsch. Gesellsch. f. Gynaek. 16: 172-223, 1920.

Shaw: Muenchen. med. Wchnschr. 59:2536, 1912.

Smithies: Surg. Gynec. Obst. 36: 61-63, January, 1923.

Stevens: J. Radiol. 4:239-241, July, 1923.

Stenbeck: Grenzgeb. d. Med. u. Chir. 6:347, 1900.

Stone: Am. J. Roentgenol. 9:502-

Sjorgen: Swedish Med.Soc., 1899. 507, August, 1922.

Voigt: Aerzte. Verein, Hamburg. 1896.

Warnekros: Zentralbl. f. Gynaek. 42:620-625, 1918.

Wintz and Baumeister: Muenchen. med. Wchnschr. 42:1669, 1915.

Wood and Prime: J. Cancer Research, 1:118, January, 1916 (Proc. Am. Asso. Cancer Research).

Dental Regional Roentgenography, Shadow Values in Relation to Normal Bone Construction*

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IT is often impossible to interpret a dental x-ray picture because of faulty technique in its taking. By far the greatest difficulty arises from the picture having been taken from some unusual angle or on an incorrectly posed film. Such a procedure causes penetration to take place through tissues which should not appear in the area normally, their resistance to penetration must therefore be discounted against the normal in an effort to make an interpretation. A thorough knowledge of the normal for the various areas must therefore be recognized.

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The practice of taking dental roentgenograms with the patient on a table only adds to the difficulty of technique of the operation. It is by far, a simpler procedure to have the patient seated and use a chair in the same position for each sitting, so that the work can be better regulated. On a table, the patient may elevate or lower the head without any perceptible difference. The position of the pillow, either high or low, will cause a difference in the angle of roentgenographic penetration to so great an extent that pictures of the same area taken in the prone and then the sitting position will differ in many respects. In the sitting position the tube can be set at various angles from the horizontal plane about a patient, with greater ease than it can with the patient prone.

At times one may have a proper arrangement of the necessary field and direction of ray, yet the difficulty arises in the patient maintaining the film in the proper position and plane. For this purpose there have been many mechanical contrivances devised. Each has its good points. It has been my custom to use a wooden block as pictured here. (Fig. 1). This block gives the necessary and proper support to the film and helps to maintain it in the proper plane. It is easily sterilized by boiling and is inexpensive. The patient finds it more comfortable to

bite upon a block of this size than to maintain a smaller metal piece in position. The wood does not injure the teeth and lastly, such parts of the block as are in the path of the protected rays do not register on the film sufficiently to interfere with its reading.

The next warning which might be voiced is in regard to the placing of the film in the various positions in the patient's mouth. It is always essential to maintain the film surface flat and in one plane. This is not a simple thing to do in every mouth. In some the vault is higher than others, some have a contracted occlusal arch, and some a broad one, all of which must be considered in taking pictures. The greater the variation and more acute the angles the more restricted is the area which can be pictured properly on any one film.

This now brings the subject to the point of placing the film for the taking of pictures. The proper position at all times is such that one can have the proper relation, direction of ray, plane of the subject and place of the film. The rays should penetrate the film at right angles to the film and the subject should be in as near the plane of either the film or rays as possible. However, the teeth are often curved and rotated in their sockets, so that to picture them in reference to their position often causes difficulties. The relation of film position is therefore shown in the accompanying diagram (Figs. 2 and 3) in relation to the average arch and inclinations as encountered in practice with the teeth and soft tissues in their normal positions.

To picture every tooth in a mouth, where all the teeth are present in normal positions and where each tooth is to appear on the film with a clearly defined apical area and well pictured pulp chamber and root canal, requires fourteen exposures. These are indicated in the accompaying chart. There is a difference in the alignment of the teeth of the upper and lower jaws. This calls for a slight difference in the position for picturing the teeth. The molar area is shown by line 4 on the chart. (Fig. 2). The molars in either jaw can usually be pictured with the film in one plane as is indicated by the straight lines within either arch. There is a slight change from a straight line, in the arch of occlusion which begins to be marked at the area of the bicuspid teeth. These teeth therefore are better picturd on a separate film from the molars. Focusing the tube as is

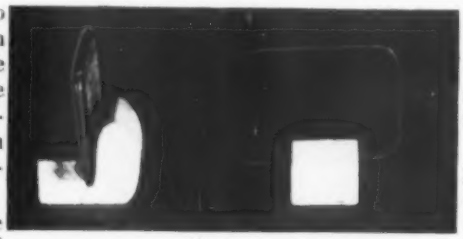

Fig. 1

shown by line 3 is a better position for the bicuspid teeth, while the cuspids are still further along the arch, in fact acting as keystone teeth for their respective side which should be pictured as indicated by line 2. In any of these positions, teeth on either side of the designated tooth will appear on the film. However, by the above indicated method the desired tooth, if placed in the middle of the film, will be pictured in the easiest and most normal manner. The central and lateral incisors are about in a line and if a film is placed squarely behind them and the tube focused as indicated as 1, a better picture will result, and one of easy interpretation.

In the lower jaw the process outlined above can be carried out by having the tube focused in a horizontal plane. The picturing of the various areas of the upper jaw requires in addition to the proper placing of the film and focusing of the tube, some alteration in its elevation in the several positions. This is diagramatically shown in the accompanying drawing (Fig. 3).

In these drawings, H represents the horizontal line, while M represents the molar area, B the bicuspid area, C the cuspid area and L the central and lateral incisor areas. The line of the tube focus is indicated by the same numbering as in the first chart, so that the relative position of tube to the patient's mouth and the elevation for any area can be estimated by combining the corresponding lines on both charts.

To picture the teeth in the upper jaw it is necessary to elevate the tube from 25 to 45 degrees from the horizontal position when the patient is using a chair and sitting in the upright position. This variation should be governed by the area to be pictured and as indicated in the charts. These elevations are not absolute but relative. The vault of the mouth may not permit placing the film so that these angles can be used, so that the operator must govern himself by the condition as he finds it and increase or decrease the angle over the average, to suit the individual case.

After having pictured the areas in the above manner, it is essential to know what should be pictured under the given technique in such areas. A brief outline of some of the more prominent and more constant landmarks as they are projected onto the film will now be undertaken. Again beginning with the lower jaw, there are four illustrations given here (Figs. 4, 5, 6, and 7), in which the following prominent and important areas for roentgenographic consideration are mentioned. In the molar area, the external oblique ridge, the mylohyoid ridge internally and within the bone the beginning of the inferior dental canal, in the bicuspid area, the mental foramen on the external aspect, while centrally, on the inner aspect the mylohyoid ridge terminates in the two mental spines. These are of importance.

The roentgenographic significance of these promontories is that they alter penetration in a characteristic

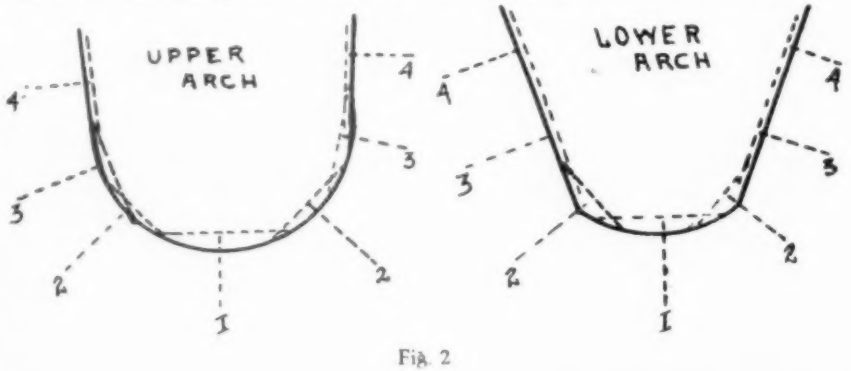

Fig. 2

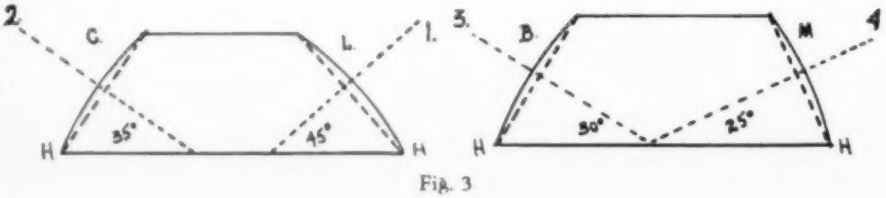

Fig. 3

manner. The external oblique ridge and the mylohyoid ridge being bone promontories and composed of heavy bone formations, cause an increased resistance for their positions and in consequence, where they are pictured, less alveolar tissue is pictured. Their position and the position they may assume when projected onto the film must be known if they are to be recognized as an area of normal bone or process. The inferior dental canal is more clearly shown in the illustration showing the outer table of bone removed (Fig. 6). It is an area in which soft tissue is more abundantly found than in the haversian canals and therefore can be prominently pictured. The mental foramen is the termination of this canal through the outer plate of bone and its position is usually between the first and second bicuspid teeth, and at their apex.

Translating these promontories into shadow grade value, it will be found that normally there is a change in the grade of shadow about the molars. The alveolar shadow (grade II-a), is gradually replaced, as it is traced backward by shadow of denser bone (grade II-b), until in the third molar area there is little or no alveolar bone pictured. That which is pictured is more often pictured apically about these teeth. The cause for the loss of alveolar shadow (grade II-a), and the increase in denser bone shadow (grade II-b), is because of the penetration of these areas being through heavy bony prominences as described. The inferior dental canal is most often easily recognized as an area of two parallel or almost parallel lines of denser bone shadow (grade II-b), between which there is to be seen a predominance of soft tissue (grade I), shadow. Because of its lowered position in the jaw this canal is not so often pictured about the bicuspid teeth as about the molars, but in this area the mental foramen is pictured. Here we find an area of soft tissue (grade I) shadow, more or less definitely surrounded by denser bone (grade II-b) shadow. This foramen at times is so closely projected to the tooth root as to be confused with some process of infection or abscess formation. However a careful study of the area, particularly with reference to the tooth and decay or filling, as might be pictured in it, will help to clear up the diagnosis and make the differentiation. The mental spines are dense bone structure and when projected onto a picture they appear as an increase in bone (grade II-b) shadow.

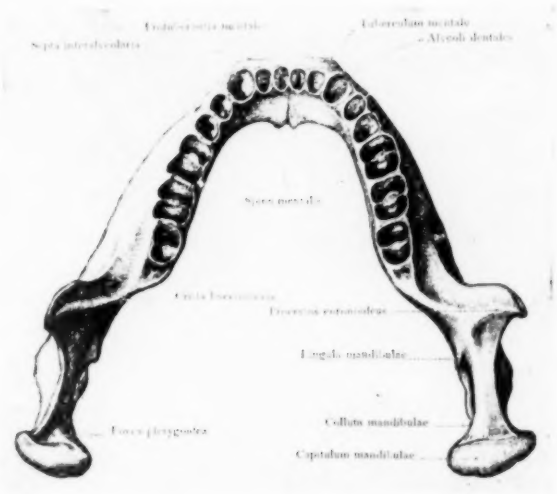

Fig. 4

For the study of the upper jaw there are three illustrations shown. In the molar area the major palatine foramen and the walls of the sphenomaxillary fossa in the direction of which the coronoid process of the lower jaw is often projected, are the

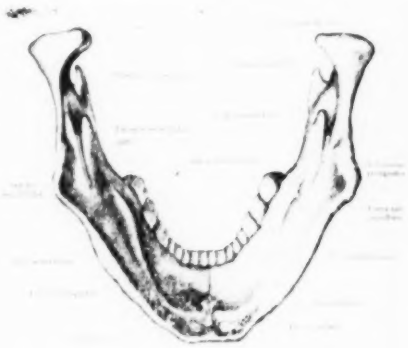

Fig. 5

directed. The foramen is just back of the third molar and contains more soft tissue (grade I) shadow than the surrounding process. It is at times mistaken for the broken down first landmarks to which attention is denser bone and when projected into process of an infection. The coronoid process of the lower jaw is of this space is often mistaken for a tooth root or tooth. The coronoid process is forced into this area on the opening of the mouth to hold the film in position. Passing forward, at the molar area and particularly between the second and first molars the maxillary sinus comes into view at the apex of the lingual root. As this area is pictured through more compact bone than alveolar process, the resistance to penetration, particularly alone bone margins, is greater. This causes the sinus to be outlined by denser shadow. As this sinus extends both forward and backward from this point, its extent can be determined by following the denser bone shadow. It will most often be noted that there is a very distinct V shadow formation of grade II-b shadow in which there is little or no alveolar (grade II-a) shadow but which is dark, signifying easy penetrability. This V has a narrow anterior limb and a thicker posterior limb. This fact can be made use of in identifying pictures of edentulous

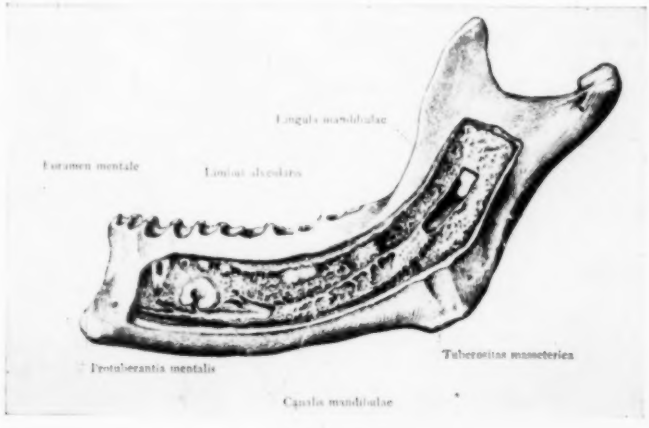

Fig. 6

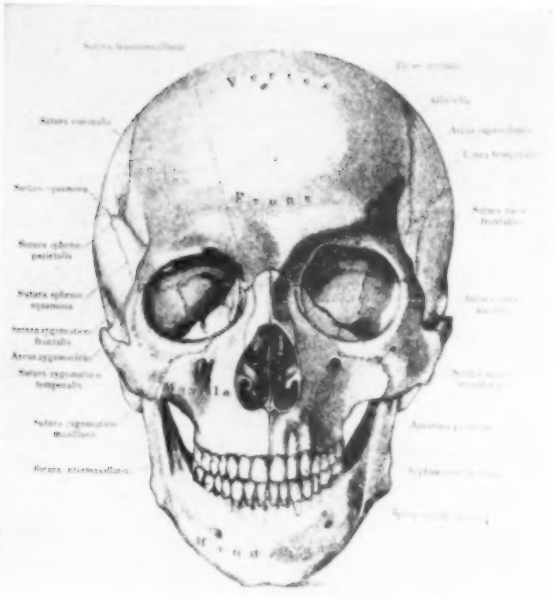

Fig. 7

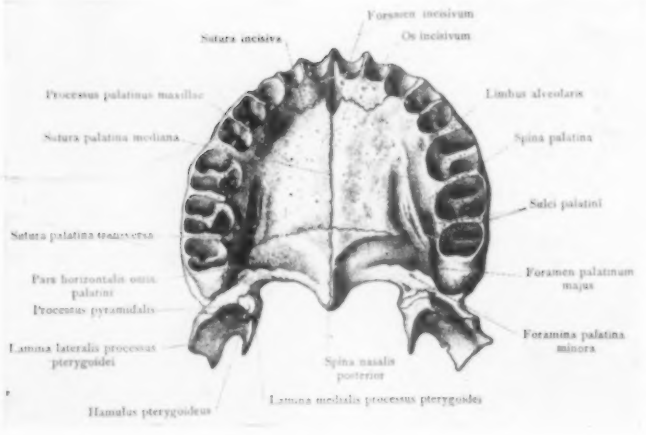

Fig. 8

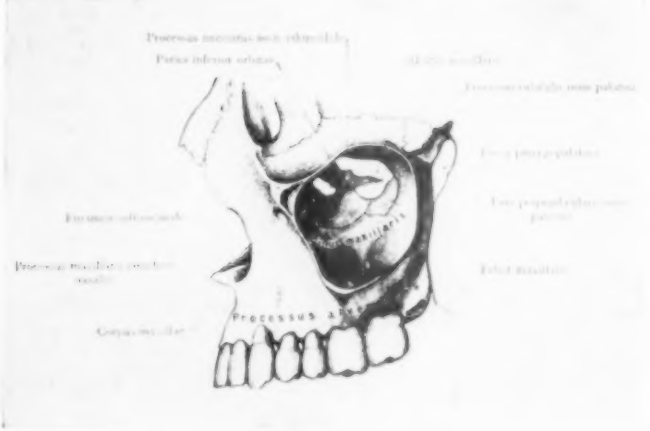

Fig. 9

jaws and to determine the side pictured. The V formation results from light penetration through the lower and anterior and posterior walls of the maxillary sinus which are the walls of the molar bone. This wall is thin and has little or no alveolar bone between its plates. The anterior wall is straighter and more nearly perpendicular while the posterior rises more gradually. This explains the narrow anterior limb of the V and the broader posterior. The position of the maxillary sinus is clearly shown in the accompanying illustration in which the malar wall has been removed (Fig. 9).

The next most important landmark and point of confusion in the upper jaw is the incisor space, locating the incisor foramen (Fig. 8). This is to be found in the middle of the jaw and back of and between the upper central incisor teeth. There is always some soft tissue to be found in this area. When pictures are taken from such positions as will tend to project this area over either one of the roots of the central incisor it is often mistaken for some necrotic process or infection. The intermaxillary suture divides this space and occasionally this line of cleavage is so squarely penetrated as to be pictured as a line through the space.

In a normal area, therefore, pictured squarely through this space one may expect to see alveolar (grade II-a) shadow surrounding the teeth and between the central incisors. However in the exact center, and triangular in shape, one should find an area of lesser resistance (grade I shadow) in alveolar (grade II-a) shadow. As was said before, this area may be projected over a root area and may assume a different shape, so that one may be led to error when not appreciating the existing normal arrangement of tissue and the direction of ray penetration.

There are numerous other points of interest in diagnosis in both the upper and lower jaws, but to include them all would make these papers too lengthy. However the most important of these have been explained. If any question of importance has been omitted, it will be gladly taken up subsequently, if the editor be addressed, or a request forwarded to the writer.

The Urological Aspect of Roentgenology (Technique and Case Reports)*

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The progress made in recent years toward more accurate diagnosis in urology may be attributed largely to closer cooperation between the urologist and roentgenologist. For years the two branches have struggled along too independently. Time and circumstances have fortunately brought them to a closer realization of each other's merits, and the combined methods have brought about a tremendous amount of good. For example, a radiogram of the urinary tract may reveal a shadow resembling a renal or ureteral calculus, when in reality it may be a calcified mesenteric gland or gall stone, or other possible conditions in the gastro-intestinal tract. On the other hand, cystoscopic data alone, in lesions of the upper urinary tract, are relatively of little value. But, if a leaded catheter be inserted into the ureter or renal pelvis, and then a radiogram made after injecting an opaque solution, the exact relation between the shadow and the kidney or ureter is immediately apparent. The combined method is not only of value in cases of calculus, but equally valuable in many other urinary affections, such as renal tumor, hydronephrosis, ureteral stricture, or kinking. Moreover, during cystoscopy one occasionally notices an abnormal opening into a bladder. One is at a loss to know its extent without calling on the roentgenologist to ray the bladder after the bladder has been injected with an opaque solution or after a leaded catheter has been inserted into the opening. Diverticuli and double ureter, which would otherwise be overlooked, are often demonstrated in this manner.

It might be well not to omit, at this point, the fact, that the x-ray is only indirect evidence, and that the findings are gross and not microscopical.

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Routine Method of Examination

A careful history and a complete physical examination are absolutely essential and extremely valuable. After this procedure, if a urological lesion is suspected, the patient is referred to the roentgenologist for the preliminary radiogram, which should be of both kidneys, ureters and bladder, including the gall-bladder.

Regardless of the preliminary findings the patient is then prepared for any further work in a very simple manner. A large soap-suds enema is given. Cathartics are not advised. The patient is instructed not to eat breakfast and to report ready for examination at an early hour.

Cystoscopic Technique

It is well to remember from a diagnostic standpoint, that cysto-

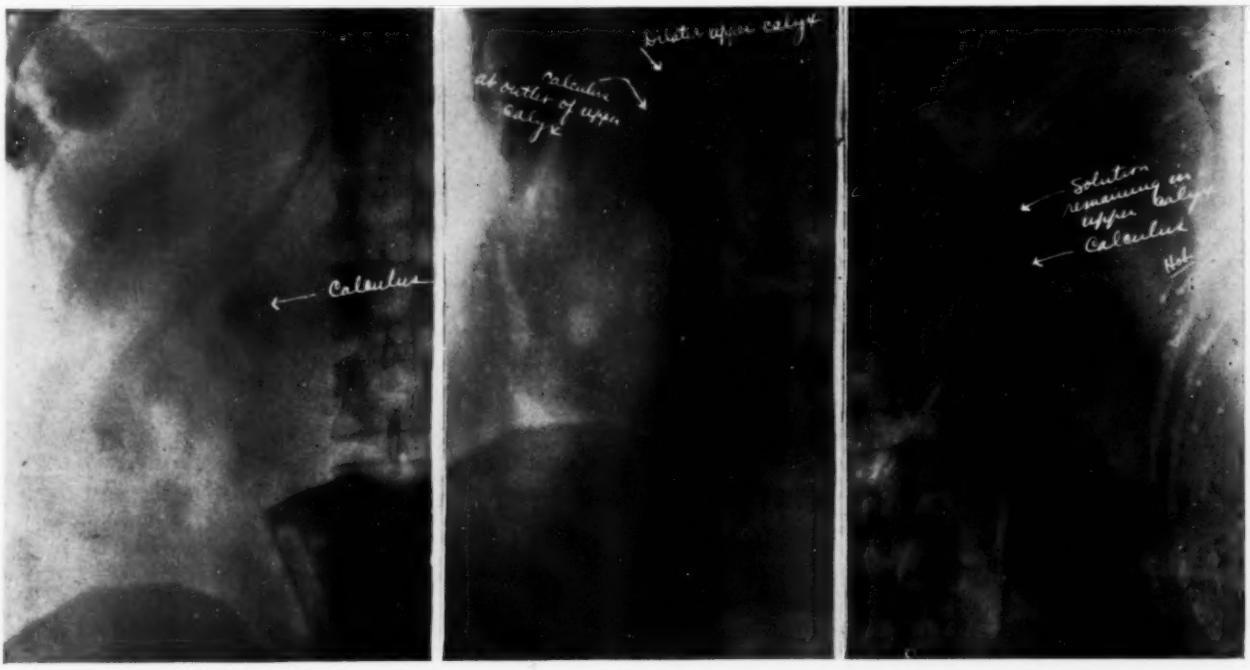

Figure 1.

Case 1—(A1('33): Female, age 31, complained of pain in right side of abdomen and back with frequent and painful micturition. Duration of symptoms two years. There was no pain in the bladder prior to a previous cystoscopy done elsewhere at which time a radiogram was made and this shadow was not demonstrated. Weight 180. Buckey diaphragm and the technique used was as outlined above.

Figure 2.

Case 1—(A1433): Pyelogram showing the appearance of the calculus at the outlet of the upper calyx or right kidney with a dilation of the calyx above the point of obstruction caused by the calculus.

Figure 3.

Case 1—(A1433): Illustration showing the appearance of the kidney after all the solution was withdrawn in the syringe. The calculus was shown at the outlet and did not allow all the solution to pass out from the calyx.

These three pictures show that the combined methods revealed the exact location of the stone.

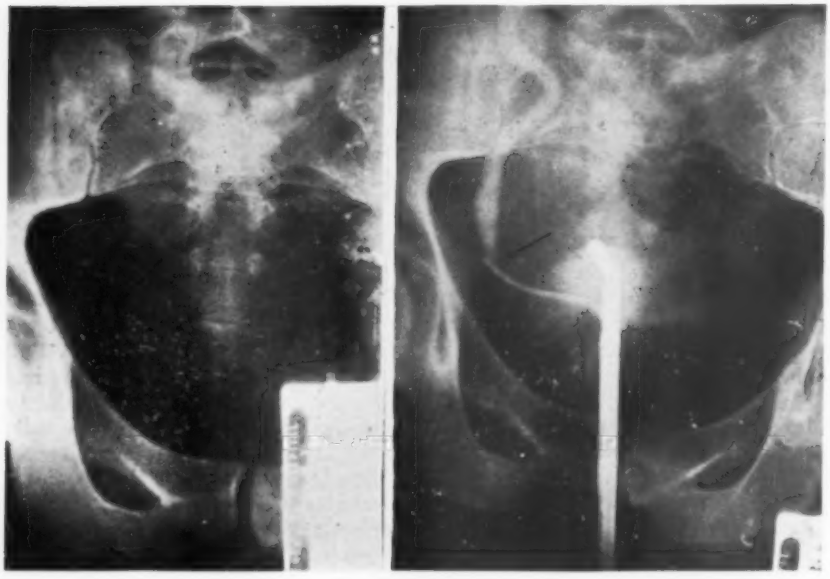

Figure 4.

Case 2—(A1315): Male, age 26, complained of pain in the right lower abdominal quadrant. Complete examination was negative except for slight tenderness about midway between the spine of the ischium and umbilicus and a few red blood cells in the urine. His symptoms had persisted for six years and closely resembled an appendicitis, having had several attacks with nausea, vomiting and chills. Preliminary radiogram located a shadow opposite the spine of the ischium corresponding to the area of tenderness. Cystoscopy showed a gaping right ureteral orifice with marked inflammation. A leaded catheter was inserted about 7 cm. and met with this obstruction. Without moving the cystoscope or catheter a picture was taken showing the catheter up to the point of obstruction caused by the calculus.

Figure 5.

Case 2—(A1315): Ureterogram showing the calculus and a slight dilatation of the ureter above the point of obstruction (12.5 per cent sodium iodide). This patient passed the stone a few days after the examination.

scopic procedure done alone is only of value in locating lesions in the bladder and for collecting urine from each kidney, either for analysis, culture or functional test. When used in combination with radiology it serves another purpose, therefore its value cannot be overestimated.

When the preliminary radiogram is negative, all the cystoscopic data possible should be collected before further radiograms are made. For example the routine technique at cystoscopy has been as follows: First, a thorough exploration of the bladder wall; second, a study of the appearance of the sphincter muscle; third, the appearance of both ureters and the character of the efflux from each; fourth, the collection of a sufficient amount of urine from each ureter; and fifth, a differential functional test is then made, using phenolsulphonephthalein or indigo-carmine. For all ordinary purposes, the latter dye has proved itself to be very satisfactory.

The technique from this point is entirely dependent on the individual case, and varies considerably. The principal question which usually arises here is whether or not a pyelogram or ureterogram is indicated. Our routine practice has been to use the utmost conservatism in employ-

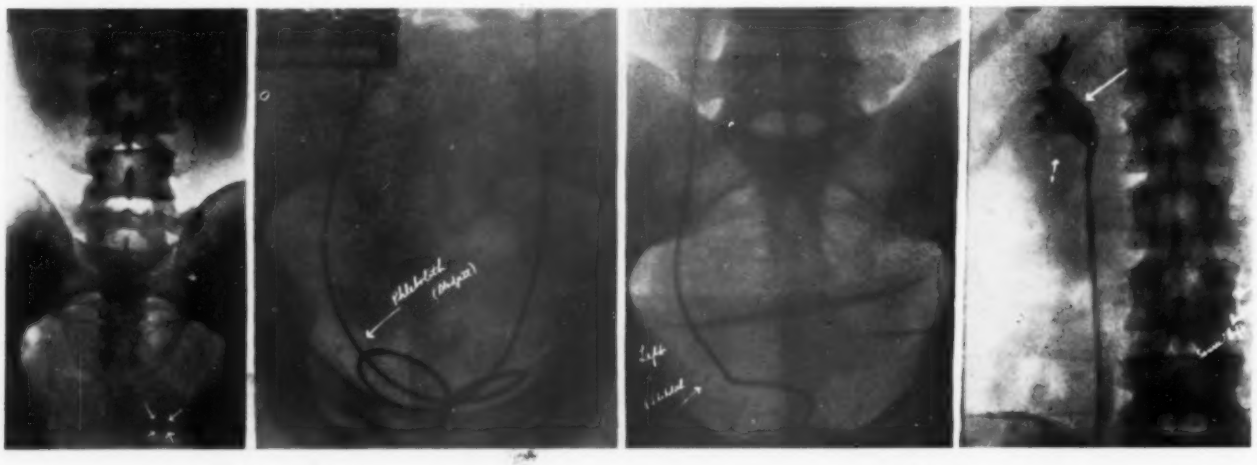

Figure 6.

Case 3—(A1407): Male, age 35, complained of pain in the lower left quadrant with associated tenderness opposite the spine of the left ischium. He stated that four years ago a pain of similar character was encountered in the region of the left kidney and a radiogram taken in New York City at that time demonstrated a shadow supposedly in the left kidney. He was not cystoscoped and consequently no further urological study was made in the meantime. Preliminary radiogram of both kidneys and ureters showed only a shadow which in all probability was a calculus in the ureter opposite the left ischium. Cystoscopy showed the characteristic appearance of the left orifice and a catheter could not be inserted farther than 1 cm. Consequently no further pictures were made. A filiform bougie was passed and left in for twenty-four hours since which time the patient is passing the calculus in small particles.

Figure 7.

Case 4—(A1367): Illustration showing how the shadow of a suspected ureteral calculus is differentiated from a phlebolith. One is here shown entirely outside of the course of the ureter.

Figure 8.

Case 5—(A1325): Male, age 39. Illustration showing how a shadow in the region of the lower ureter might be mistaken for a calculus. The relation of the catheter to the shadow is valuable in differential diagnosis.

Figure 9.

Case 6—(A1431): Female, aged 38, complained of severe hematuria and aching pains in the back. Cystoscopy showed a normal bladder and ureteral orifices. Clear urine spurted from the right; bloody efflux from left side. Function on right side fair, but almost none on left. Almost clear blood came through the catheter after it had been introduced into the left renal pelvis, thus ruling out a ureteral lesion. Pyelogram (12.5 per cent Sodium Iodide), shows destruction of the lower calyx, with rupture of a tumor into the pelvis. (Note the distinct outline of this on the pyelogram.)

Left nephrectomy was done and the pathological diagnosis was as follows: hemorrhagic cyst and two papillomatous tumors in left kidney.

Figure 10.

Case 7—(A1111): Female, aged 42, illustrating another pyelogram and radiogram of a right renal tumor. Note the complete destruction of the calyces, especially the sharp line between the lower calyx and the dark outline of the tumor below. This case presented mostly pain and tenderness over the kidney, with occasional attacks of hematuria and frequency. The mass could be palpated by bimanual examination.

Figure 11.

Case 8—(A1345): Female, age 58. Complained of pain in the lower portion of the right upper quadrant and back, with slight frequency of urination. The surgeon in this case desired a urological study made before operation. Function of both kidneys was good and this pyelogram of the right kidney was obtained. It might easily be mistaken for an abnormal condition, but at operation the kidney was found turned on its axis. A long retrocecal appendix accounted for the symptoms.

Figure 12.

Case 9—(1410): Female, age 40, complained of bloody urine at times with marked frequency and pain in the right back. Culture of the right kidney sample showed numerous colonies of mixed colon and streptococcus infection. Culture of the left kidney sample was negative. Function on the right side was considerably impaired. Pyelogram demonstrated lesions as indicated by the arrows. However, this pyelogram showed too little pathology to indicate nephrectomy and was therefore very valuable information.

Figure 13.

Case 10—(A1200): Female, age 28. Case of pyonephrosis. This illustration is used to show the value of a plain radiogram before any cystoscopic procedure. The outline of a large kidney including its destroyed pelvis is easily detected. The cystoscopic data collected in this case showed that no urine nor pus came from this side, indicating a complete walling off of the infectious process. Because of the fact that there was good function from the left side and none whatsoever from the right, together with the evidence collected from the radiogram, a right nephrectomy was indicated. The diagnosis was confirmed at operation.

ing pyelography. If enough information can be collected without a pyelogram, why take one? If for example, a case of pyuria shows the origin of the pus to be from one kidney, with the corresponding functional test very low, and the other side good, together with clinical signs indicating nephrectomy, or medical treatment, enough evidence is at hand without taking a pyelogram. On the other hand, however, in certain cases, particularly renal tumor, when cystoscopic data are insufficient, a pyelogram is of utmost value. In certain infectious types of kidney, it is occasionally done to ascertain the extent of damage to a kidney.

X-Ray Technique

One of the most important factors to consider in urological radiography is the weight of the patient. In fleshy individuals there is more scattered or secondary radiation and therefore the negative is lacking in contrast, giving us the characteristic gray and black film. The Bucky Diaphragm, however, eliminates a large portion of the scattered radiation, thus enabling us to obtain fully as good negatives on fleshy individuals as on smaller individuals.

The technique we have employed might be described as customarily using a 4.5 to 5 inch spark gap, with

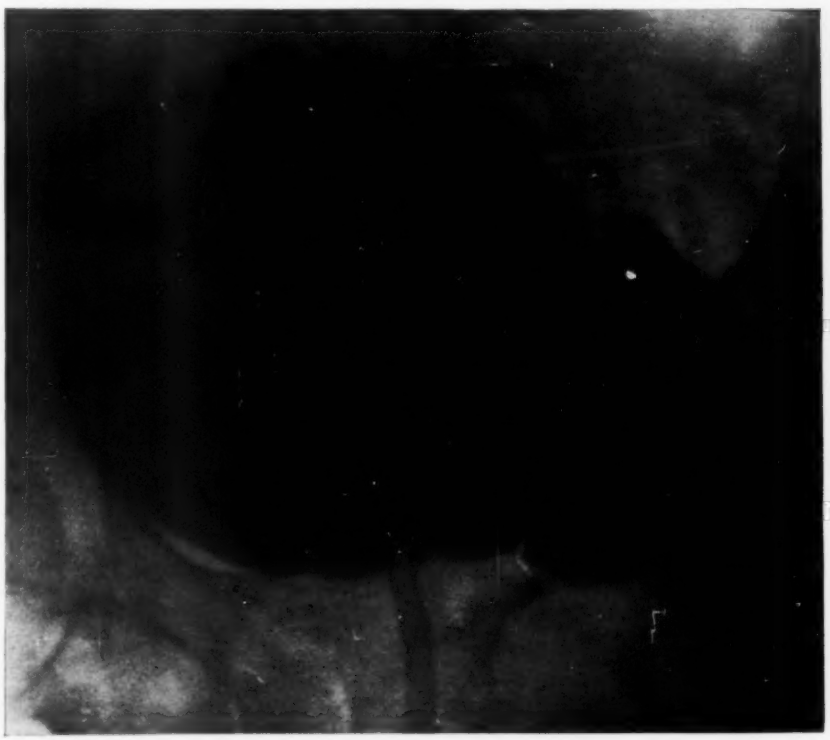

Figure 14.

Case 11—(A1189): Male, age 53, complained of painful micturition. Cystoscopy revealed a moderate cystitis and normal ureteral orifices. Immediately above the left orifice was an extra small opening, suspicious of diverticulum or double ureter. Catheter later inserted into bladder and 12.5 per cent sodium iodide injected by gravity method. The result was that this diverticulum was clearly demonstrated both by fluoroscopy and radiography.

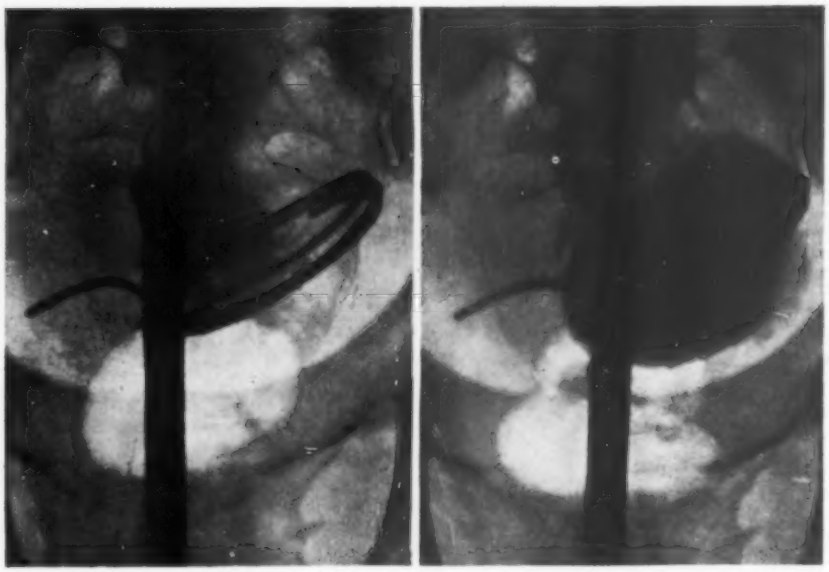

Figure 15.

Case 12—(A1191): Male, age 60. Complained of painful micturition. There was present severe hematuria and pyuria. Cystoscopy revealed a rather large extra opening medial to the left orifice. A ureteral catheter was inserted as far as possible without any apparent obstruction being met. Radiogram showed catheter coiled up in left bladder region.

Figure 16.

Case 12—(A1191): Same case, showing injection of 12.5 per cent sodium iodide through the catheter which demonstrated very clearly a large diverticulum. Apparently none of the solution returned into the bladder. We believe that this method may prove of considerable value in the future.

25 ma., varying the time from 5 to 8 seconds at the standard 25 inch distance. One essential feature in kidney radiography in general, is the necessity of absolute immobilization, by holding the breath. This is one of the most difficult things to contend with, as simple as it may seem. We instruct the patient not to take a deep breath, for our observations have been that they gradually expel air during the exposure. This is especially important in pyelography because one desires always to bring out the sharpest possible detail of the calyces. It is best to have them stop breathing at a point when respiration is at rest.

For bringing out detail of calculi which are low in calcium content, a shorter exposure and longer development will very often demonstrate calculi that on a longer exposed film would not be visualized.

SUMMARY

1. Either cystoscopic or radiographic examination employed alone is of relatively little value.
2. Careful history-taking and routine complete physical examinations are essential.
3. A systematic technique must be followed out in order to obtain the best results.

X-Rays and X-Ray Apparatus: An Elementary Course*

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DOSAGE BY IONIZATION.

133. By making use of the ionization produced by x-rays in an air chamber, we are provided with the only means which satisfies all the occasions laid down in Section 126. In this case the absorbing substance is air, whose absorption Friedrich and Kroenig have shown to change with the wave-length in the same manner as water (and therefore tissue). We shall therefore examine somewhat in detail the principles underlying the use of ionization chambers as dosage measurers.

In Sections 41 and 42, the meaning of the ionization of a gas was explained, while in Section 76 attention was directed to the fact that a beam of x-rays ionizes a gas through which it passes. In the latter section it was also assumed that the intensity of a beam of x-rays was inversely proportional to the time of discharge of a gold leaf electroscope when the air surrounding the leaf was ionized by the rays. We wish now to know how this principle can be used for the accurate measure of dosage. It is applied in two different ways, (1) by the galvanometer method, in which case the *intensity* of the beam corresponds to a *steady* deflection of the instrument, (2) by an electrometer method, in which case one may *either* measure intensity by observing the time of discharge, in whole or in part, of a charged electrometer (for example an electroscope), *or*, one may measure the integrated effect of the rays over the whole time of application. To understand either of these methods, a few fundamental ideas must be clear.

SATURATION IONIZATION CURRENT.

134. Suppose a circuit is made containing two insulated plates P and Q (Fig. 103), a galvanometer G and a battery B. Generally speaking, if there is an air gap between P and Q, the circuit is not complete and no current is indicated by the galvanometer. (It will be recalled that a galvanometer is an instrument in which a steady deflection of the indicator corresponds to the magnitude of the current in the circuit. It is used for indicating feeble currents, sometimes of an intensity equal to only one ten-millionth of an ampere).

If, however, a beam of x-rays is allowed to traverse part of the space between P and Q, the air becomes ionized and the galvanometer now registers a current. From the work of Sections 41 and 42, it should be clear that this current is due to a flow of positive ions to the negative

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plate P, of negative ions to the positive plate Q. Should the beam of rays be made more intense, more ions are formed, a bigger current results, and a greater deflection of the galvanometer. But, once more, the deflection will remain steady at the new value, provided conditions otherwise do not alter. With such an arrangement, therefore, the more intense the beam, the greater the steady deflection of the galvanometer. We may, accordingly, take the galvanometer deflection as a measure of the intensity of the beam, *provided the ionization current has its saturation value* (see Section 69).

To obtain the saturation current, the potential difference (voltage) between P and Q must be great enough so that *all* the ions formed by the x-ray beam take part in the current. If the voltage is too small, some of the positive ions may unite with negative, or, to use the technical term, may re-combine before the ions reach the plates P and Q. The voltage, therefore, must be sufficiently high to prevent re-combination, or, in other words, so that as many ions reach the plate per second as are formed per second by the beam. When this is the case the current has its saturation value, and further increases in voltage can produce no increase in the current.

135. In the practical application of this means of measuring intensity, the plates P and Q with air space between, correspond to what is called the *ionization chamber*. Regarding the most suitable form for such chambers, much work has been done by Duane. In Fig. 104 an illustration is given of a type in which saturation is obtained by a voltage as low as 20. In this form the central plate corresponds to P of Fig. 103, while the two other plates (in electrical connection) correspond to Q. As the chamber is quite small and may be attached to the rest of the circuit by means of suitable long flexible leads, it can readily be moved about from place to place. The galvanometer, of course, is permanently set up on some suitable shelf where it is as free from external disturbance as possible.

With such an arrangement, therefore, the *intensity* of a beam at the ionization chamber is measured in terms of the steady deflection of the galvanometer. But, it is asked, what unit of dosage is used? Before answering that question it is necessary to recall one or two fundamental electrical ideas.

136. (1) What is called the absolute electrostatic unit of quantity is such that the force of repulsion between two such units placed 1 cm. apart in air is 1 dyne.

(2) A current is measured by the quantity of electricity passing any "section" of a circuit each second. 1 ampere=1 coulomb per second =300,000,000 absolute electrostatic units per second.

(3) The greater the volume of air ionized by x-rays, the greater the number of ions taking part in the ionization current.

(4) It is, therefore, possible by measuring accurately the volume in which ions are formed to calculate from the observed galvanometer current the quantity of electricity contributed each second by each cubic centimeter of the ionized air, or, if you like, the ionized current due to each cubic centimeter.

Since this is the case, Dr. Duane has defined a unit of intensity which is of universal application. It is "that x-ray beam which would produce one absolute electrostatic unit of *current* in each cubic centimeter of air through which it passes, provided the current has its saturation value." It should be carefully noted that this unit which is denoted by the letter E is a unit of intensity. The corresponding unit of dosage will therefore be one E unit applied for one second, and the dose applied may, therefore, be expressed as so many E S units.

As an example of the magnitude of actual intensities when expressed in E units we give the following figures taken from a paper by Duane. With back-up 32,000 volts, tube current 5 ma., filter 2.6 mm. aluminum, the intensity at a tube distance of 40 cm. is 0.38 E. With back-up 200,000 volts, tube current 4 ma., filter ½ mm. copper, tube distance 80 cm., intensity=0.21 E.

THE ERYTHEMA DOSE IN E. S. UNITS.

137. For the following information regarding the magnitude of the erythema dose, when expressed in E S units, the writer is indebted to Dr. Duane. With a beam of effective wave-length 0.15 to 0.16 A. U., of feeble intensity (about 0.07 E. units), the erythema dose is 1500 E S. units. This means, of course, that with a beam of such intensity the total time of application would be found from the simple relation 0.07 x time in seconds=1500, or the time = 1500/.07 = 21428 seconds = 5 hrs. 57 min. 8 secs.

Other workers give somewhat different estimates of the E. S. D. For example, Dr. Duane reports, "The erythema dose used at the Massachusetts General Hospital is 800 E S. and that estimated by Dr. Pfahler of Philadelphia is about 700 E S. Some of the erythema doses estimated by men in the Middle West run in the neighborhood of 1400 E. S." In this connection, it is well to remember (as has already been pointed out) that because of its biological nature, there are bound to be differences in the estimates of different workers. There is a big difference in the reaction of different individuals, while the exact degree of erythema used as a standard by different investigators will not necessarily be the same. But the important point which the writer wishes to emphasize lies in the fact that to all workers, 1 E. S. unit means exactly the same thing. It is an absolute universal physical unit.

138. But, the radiologist objects, how is one with a very limited knowledge of physics to work out the intensity in these E. S. units? And, even if one were able to do so, would not the time required in measuring volumes of ionized air, calibrating a galvanometer and so on, render such a method far from simple? Now, as a matter of fact such a calculation would not even be possible with an ionization chamber such as illustrated in Fig. 104, because of the effect of secondary rays from the walls of

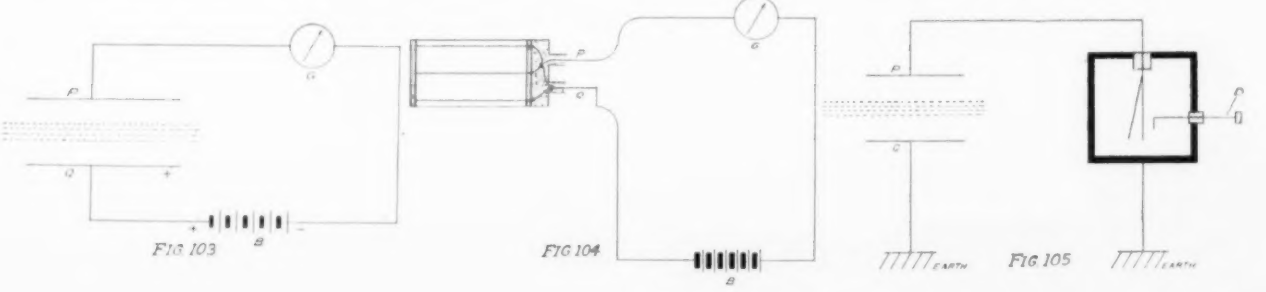

FIG. 103 FIG. 104 FIG. 105

the chamber. Before it could be used for the calculation of the intensity of a beam in E units, comparison with a large standard air chamber (where effects of secondary rays are eliminated or taken into account) is necessary. What, then, is a radiologist to do? The answer is—buy an outfit for which the necessary calculations have been made. There is no reason why a simple ionization set consisting of a chamber, galvanometer and scale (for reading deflection of the galvanometer) should not be sold *with scale already calibrated* so that one could read directly in E units.

If such calibration were supplied and there is no reason why this should not be done, the above arrangement would be extremely simple and convenient for the practicing radiologist. With it he could:

(1) Read off directly from the scale the intensity of the beam utilized in any desired place, for example, following Duane, both where the rays enter a patient and where they leave one.

(2) Measure the intensity at various depths by immersing the chamber in a water phantom (see Section 151).

(3) Measure the effective wave-length by the method already outlined in Section 112. (By means of such an intensity set, the particular thickness of aluminum which reduces the intensity of a beam to the same extent as 1 mm. of copper could readily be found. Then the application of Figure 93, to find the effective wave-length is a simple matter).

Finally, a radiologist so equipped would record his treatment in a manner which could give rise to no ambiguity anywhere, for he would give the quality in effective wave-length, the intensity in E units, and the time of application. Readers of this journal will recall a recent article by Pfahler[1], in which is given a record of some actual measurements made by this method.

139. The method is not free from objections, one of which lies in the extreme sensitivity of the galvanometer required. Ionization currents are very feeble compared with currents ordinarily used, and to get readable deflections the instrument must be so sensitive that it is easily affected by vibrations and, moreover, easily broken. This difficulty may possibly be overcome by using some sort of amplifying arrangement such as one finds in radio sets. Indeed, in Europe a device has been put on the market which amplifies the ionization current to such an extent that an instrument not much more sensitive than a milliammeter, may be used instead of the extremely sensitive galvanometer.

A more serious objection to the method lies in the fact that for most ionization chambers, the calibration of the scale would not be the same for all wave-lengths. This may be lessened considerably by using chambers made of substance of low atomic weight such as carbon, or, according to Kroenig and Friedrich, may be almost entirely eliminated by the use of a chamber of cow's horn whose surface is made conducting by graphite. In any case the error would not be great provided the arrangement was utilized only for a small range of wave-lengths, and in deep therapy the range need not be very extended.

INTENSITY BY THE USE OF AN ELECTROSCOPE.

140. Suppose, instead of using the galvanometer, an electroscope is utilized, connections being made as shown in Figure 105. In this case, it will be seen Q is joined to earth (grounded), while the other plate P, which is insulated, is joined to an electroscope. Normally, when the insulated system of such an arrangement (that is, the plate P, connecting wire, and electroscope support) is given a charge of electricity, the leaf remains stationary. (See however, Sections 41 and 42). If, however, the air between the plates P and Q is ionized by a beam of x-rays, ions of a charge opposite to that on the electroscope system will be attracted to the plate P, and so the system will gradually have its charge annuled, and the leaf of the electroscope will gradually fall. The greater the number of ions formed per second, the greater the number which go to the plate P, and hence the faster the leaf of the electroscope falls. In other words, *the intensity of the beam will be proportional to the rate at which the leaf falls.* Such an arrangement may, therefore, be used to measure intensity.

Here again, in actual practice, an ionization chamber corresponds to the plates P and Q, the arrangement used being somewhat similar to Figure 106. In this Figure, C represents a small ionization chamber, the insulated electrode E corresponding to plate P of Figure 105. This electrode is connected by the insulated wire K (which may be several metres long if desired) to the electroscope, care being exercised to shield the conductor K from electric disturbances by surrounding it with the outer grounded metallic shield S. To prevent ionization in the region between K and the outer shield, the space may be filled with some insulating substance such as rubber. (This would be necessary unless the space between K and S were completely shielded from the action of x-rays).

141. With this electroscope arrangement, then, intensity is measured by observing the rate at which the leaf falls, and not by reading a steady galvanometer deflection. In actual practice, therefore, the leaf is observed through a low power microscope (or in any other convenient way), and the movement over a scale is carefully timed. Intensities are directly proportional to the rate at which the leaf falls. In using the electroscope, however, care must be exercised to correct for "leakage." Even without the x-ray tube running, the leaf may fall slowly due to defective insulation, or to feeble ioni-

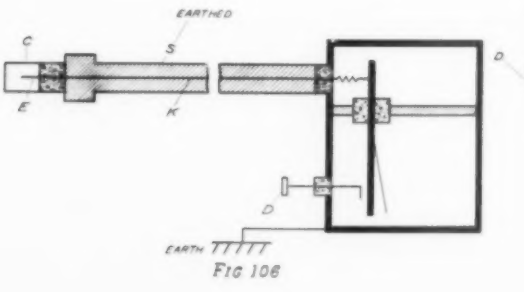

FIG 106

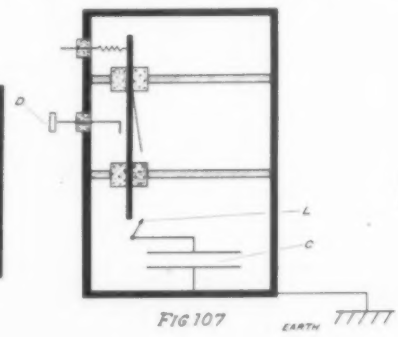

FIG 107

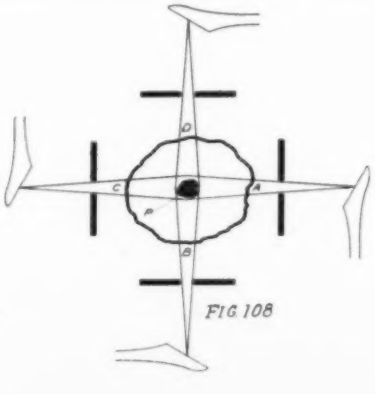

FIG 108

zation from other causes (radioactive substances about, for example; see again Section 42). With the tube in operation, leakage may result from ionization in parts of the apparatus other than the ionization chamber; for example, in the electroscope, if insufficiently protected, or in the tube connecting the chamber to the electroscope. Correction for such possible errors should always be made. This can readily be done by taking readings of the fall of the leaf when the ionization chamber is carefully shielded from the beam of rays by means of thick lead. A simple example will illustrate the method.

Suppose we are comparing the intensities of a beam in two different places and have observed the rate of fall of the leaf to be, for the first place, 5 scale divisions per second; for the second 2 divisions per second. Suppose, also, when the ionization chamber was completely protected, the leakage fall was at the rate of two divisions per minute. Then,

first intensity $5\times60-2=298$.

second intensity $2\times60-2=118$.

This follows because the ionization current due to the first intensity when corrected for the leakage error, $=5\times60$ or 300 divisions per minute less the leakage current of 2 divisions per minute. Similarly for the second intensity.

152. To use the electroscope to obtain E units, it is necessary to make use of a large standard ionization chamber (Section 138), and a calibrated electroscope of known capacity. But, here again, as in the case of the galvanometer method, there is no reason why a calibrated electroscope and corresponding ionization chamber should not be placed in the market. A description of such a calibrated set (although not in E units), is given in Section 145.

Electrometers and Direct Measure of Dosage.

113. An electroscope (or electrometer of other type), may also be used to measure the integrated effect of the product (intensity x time of application). To utilize an electroscope for this purpose, the principle involved is identical with that employed in the arrangement of Fig. 106. The only change lies in the increased capacity of the system which is discharged by the flow of ions in the chamber. The capacity may readily be increased by having in the vessel which houses the electroscope a condenser C (Fig. 107), which by means of a movable contact L may be joined to the insulated rod of the electroscope. With the condenser thus joined, the capacity of the insulated system is much greater. This means that a much greater quantity of electricity must be given to the insulated system to deflect the leaf, say, one division, than is the case when the condenser is not attached. It follows, therefore, that the amount the leaf falls due to a transfer of a million, or any number, of ions in the chamber will be much less with such increased capacity than without. In other words, if a condenser of sufficient capacity is added, the fall of the leaf becomes very slow. By choosing a high enough capacity, the leaf may fall so slowly that at the end of the treatment the electroscope is still not completely discharged. In that case, the fall of the leaf will be proportional to the *total* amount of ionization produced in the whole time of treatment, that is, to the product, intensity x time.

114. In this case, therefore, it is possible to adopt a universal unit of dosage, not of intensity. This has been done by Friedrich and Kroenig, who measure the physical dose in terms of "the *quantity* of rays which transports in 1 c. c. of air by ionization the quantity of electricity of an electrostatic unit, with a saturated current[2]." This unit is represented by the letter e, and the erythema dose in terms of it is about 165 e to 170 e.

This unit must not be confused with Duane's E unit which, once more, is a unit of intensity. The two, of course, are very closely related. An intensity of 0.5E applied for 20 seconds, means that the total quantity of electricity transported in the ionization chamber (per c. c.), is 0.5x20 or 10 e. In other words, 1 E S unit=1 e unit, in which connection it should be pointed out that in view of the magnitudes of the E. S. D. dose given above in Section 137, it looks as if Friedrich and Kroenig's value should be multiplied by 10, that is, it should be 1650—1700 e or E S units.

Duane's method has the advantage that both the intensity and the time are given, for, as has already been pointed out, a feeble intensity for a long time, has not necessarily the same biological effect as a big intensity for a corresponding short time. 100 e may mean 1 E for 100 seconds, 0.1 E for 1,000 seconds, and so on. Both units, however, are absolute and, therefore, adaptable for international usage.

Solomon's Iontometer.

115. As neither of the above units has yet come into general use, nor has been sanctioned by any international agreement, we shall call attention to an iontometer, now on the market, in connection with which a third ionization unit is made use of; one, moreover, which might also readily be universally adopted. We refer to Dr. Solomon's Iontometer, an instrument in which an ionization chamber and electroscope are used in a manner identical with that already described. The scale, however, is standardized in terms of "the ionization produced by 1 gram of radium elemnt in one second, placed at a distance (from the chamber), of 20 mm., and screened by 0.5 mm. of platinum"[3]. This is called 1 R unit, the erythema dose being equal to 1,000 R.

When, therefore, such an outfit is sold, the manufacturer supplies the number of R units which correspond to the full scale deflection of 50 divisions. As the electroscope may be used with and without a condenser,

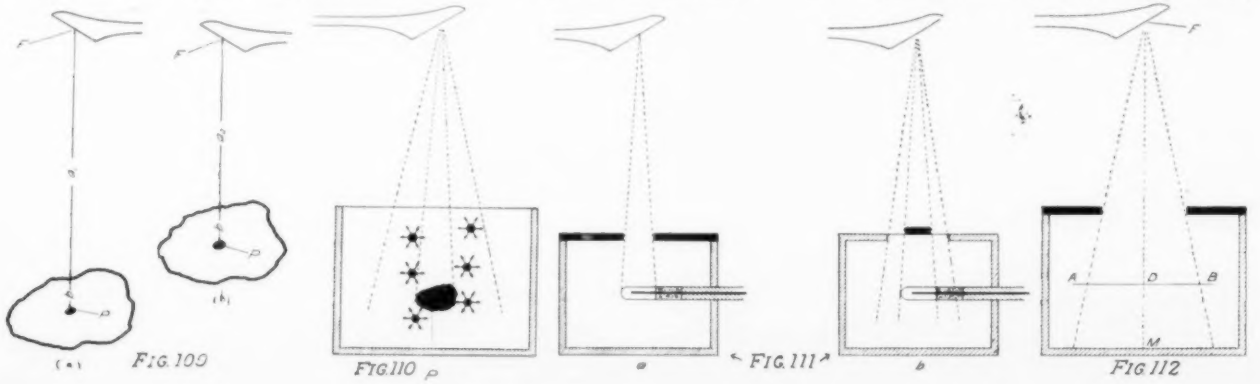

Fig. 109 (a) (b) Fig. 110 (a) (b) Fig. 111 (a) (b) Fig. 112

two constants are supplied, one for the small capacity, the other for the large capacity. To take a concrete case, in one such instrument, the fall of 50 divisions corresponds to 500 R units, or 10 R units per scale division (since there are 50 scale divisions for the large capacity); to 130 R for the small capacity. Suppose, then, with such an arrangement, the total fall of the leaf (using large capacity, was 35 scale divisions. The dose applied is simply 10 Rx35 or 350 R, that is, about one-third of an erythema dose.

By using the small capacity, the same apparatus may be used to measure intensity. For example, suppose a beam causes the leaf to fall 50 divisions in 65 seconds (using small capacity now). Since the supplied constant in this case is 130 R, this tells us that in 130 seconds the leaf fell through 50 divisions, with the radium in the proper position. In other words, since an intensity of I R per second causes a fall of 50 divisions in 130 seconds, the intensity which causes the same fall in 65 seconds must be $\frac{130}{65}$ or 2 R per second.

It will be seen then that this iontometer uses an electroscope to measure either intensity or dosage by applying exactly the same principles as those already described. The difference is solely in the unit adopted. But, here again, it is an absolute unit because it is based on the ionization produced by a definite amount of radium under specified conditions. This unit, however, is also not in general use, and the world still awaits a general agreement for an international unit of x-ray radiation. It is in the interests of both physicists and radiologists that an international unit should be adopted as speedily as possible.

146. Before leaving the subject of ionization, attention may be directed to a portable ionization chamber recently placed on the market by the Wappler Electric Company. A brief account of such an instrument will be found in a recent number of this Journal.[4]

XII.

DEEP THERAPY.

147. Most, if not all, readers are familiar with the fact that x-rays are used for treating diseased conditions both on the surface of the body and at various depths below it. In the last chapter we have tried to show how the radiologist can measure radiation in such a way that it is possible for him always to use definite and comparable doses in such treatment. While such methods are applicable to the treatment of both superficial and deep-seated tissue, in the latter case certain additional factors must be taken into consideration. The following paragraphs are devoted to a brief discussion of the most important of these.

In treating deep-seated tissue, since the diseased area may be several inches below the skin, it is obvious that the effective wave-length of the beam utilized must be very short; in other words, that the tube must be operated on very high voltage. In Section 136, for example, we have noted that Duane uses an effective wave-length of .15—.16 A. U. This means (applying the relation given in Section 107), that the voltage must be greater than $\frac{12354}{.15}$ or 82,000 volts. As a matter of fact, since the shortest wave-length is less than the effective, the voltage required is probably considerably greater than 82,000. In actual practice, potentials ranging from 100,000 to 250,000 are used.

148. Now, the use of very high voltages means that additional precautions must be taken to make sure that there is adequate protection both against electrical shock, because of defective insulation, and against possible injury from the more penetrating rays used. An operator must ever be on the watch to see that both himself and the patient are properly protected. As far as the patient is concerned, probably the best means of protection consists in having the whole x-ray apparatus, tube and all, in a separate room. Duane, for example, suspends a bulb below a hole in the ceiling of a room, while the patient receives treatment comfortably lying on a mattress on the floor of the room above.

In most cases the tube is enclosed in a holder which is supposed to provide protection against both electrical shock and against stray radiations. Purchasers of such protective holders should make sure that they are made in accordance with the protection rules already noted (Section 91). In any event it is a safe precaution to cover the body of the patient (except, of course, at the port of entry), with an ample thickness of some protective material, which should be grounded.

A third danger is found in the noxious fumes and bad air generated when very high potentials are used. It must be remembered that in deep therapy it is not a matter of taking exposures for a few seconds but of giving treatment, possibly for several hours. This point, therefore, is very important. To improve conditions in this respect, at least one firm has on the market a tube holder from which the fumes and bad air may be removed by means of an auxiliary suction pump, while the foul air is replaced by a supply of freshly filtered air. Details of various tube holders will be found in advertising literature and in the references given below.[5]

149. It is obvious that to deliver x-radiation to any deep-seated tissue, the beam of rays must pass through the skin and intervening tissue. A certain percentage of the radiant energy, therefore, will be absorbed by this normal healthy tissue. Moreover, if the beam is at all heterogeneous (as is almost always the case to some extent), practically all of the softer, long wave-length will be completely absorbed by the intervening tissues. Now, because of this absorption there is always the danger that this tissue may be seriously injured. A first principle in deep therapy, then, is that treatment must be so regulated that no serious injury is done to superficial tissue. This is done by paying attention to several factors.

(1) The soft components of a beam must be removed by high filtration. This has the added advantage that the beam utilized will be fairly homogeneous, a condition which, according to Dessauer, is essential for proper deep therapy. So necessary is the presence of a filter that safety devices are frequently used to make sure that it has not been omitted. Pfahler, for example, has an electrical arrangement by means of which a bell rings continuously if the filter is not in place. Copper, zinc and brass are all suitable materials to use for filters (Section 111).

Because the hard primary beam may cause an emission of characteristic rays from the filter itself, it is sometimes necessary to remove such a radiation by adding (on the side of the filter next the patient), a layer of some absorbing material. Substances of low density, such as wood or leather or aluminum, may be used for this purpose (see Section 116).

(2) By using as high voltage as possible and consequently the most penetrating, as well as the most homogeneous rays, the percentage of the surface intensity which exists at any given depth is increased. This follows at once from the fact that the more penetrating the rays, the less the absorption by the intervening tissue.

(3) By using the method of "cross-fire" treatment, the absorption by the superficial tissue in any one place is considerably lessened. The principle of this method, which is very simple, will be clear from a glance at Fig. 108, where P represents a diseased area within the body which is treated through four ports of entry, A, B, C and D. If the correct dose is delivered to P in four installments, one through each of the ports, it is evident that the superficial tissue in each case absorbs only one-quarter of the radiant energy which would have absorbed had only one port been used. In passing, it may be noted that for the proper use of this method, actual measurements of the dimensions involved must be made or estimated as closely as possible, and a certain amount of elementary geometry applied, but, once again, for each port of entry, the maximum dose which may be delivered is limited by the tolerance of the normal intervening tissue. Any effect exceeding an erythema must not be produced.

(4) Judgment must be used in the choice of the most suitable distance of target to patient. It must be remembered that, no matter what the distance is, the intensity at the surface is always greater than at any depth beneath it. This means that the absorption per unit volume in the superficial tissue is always greater than that per unit volume of the region treated. It follows, therefore, that the greater the fraction of the surface intensity which is delivered to a diseased area, the easier it will be to give the proper dose without superficial injuries. To make the matter concrete, suppose a region 10 cm. below the skin is to be treated with one of two beams, for the first of which the intensity at this depth is 45 per cent of the surface intensity, for the second, only 35 per cent. Obviously the 45 per cent beam would be preferable, because in that case the energy absorbed at the surface would be 100/45 or 2.2 times that absorbed by the treated area, whereas in the case of the other beam the ratio would be 100/35 or nearly 3.

Now, what has all this to do with the target-skin distance? Simply this, that for a given depth of tissue, the ratio of the depth intensity to the superficial value depends on this distance. Suppose a tumor is situated b cm. (Fig. 109, a and b) below the surface; it is not difficult to prove that if the distance target-to-skin is increased (say from a2 to a1), the intensity of the rays at the tumor becomes a greater fraction of the superficial intensity. For example, (if we neglected absorption for the time being) when the target-skin distance is 19 times the tumor depth, the intensity of the tumor is 90 per cent of that at the surface; if the target distance is made 8.5 times the tumor depth, the intensity cannot be greater than 80 per cent; while if the target distance is only 25 cm., tumor depth = 10 cm., intensity at tumor cannot be greater than 50 per cent of the surface value.

These numbers simply deal with the decrease in intensity which takes place because of the law of the inverse square, or, if you like, because of the divergence of the beam. In addition, there is, of course, always the decrease in intensity due to the absorption of the b cm. of tissue. *This, however, is always the same for any target-skin distance*, so that we may conclude that the greater the distance of the target, the greater the percentage of the intensity at the tumor. On the other hand, the farther removed the target, the longer the exposure. Practically, therefore, the most suitable distance must be chosen with due consideration to each factor. In actual use the writer has found recorded distances 62 cm., 40 cm., 50 cm., as low as 23 cm., and as high as 100 cm.

(5) In the case of a lesion near the surface, it is sometimes stated that the percentage received by the area treated may be increased by covering the skin with a layer of some substance which absorbs much the same as tissue. (Paraffin wax, beeswax, dough, are examples of substances which have been used). This, however, is not true unless the rays used are only moderately hard, with a fair admixture of soft rays. Some actual numbers will make the point clear.

Suppose a semi-superficial tumor 1 cm. below the skin is to be treated with hard rays for which the tissue absorption is accurately given by the numbers in Table XIX, (an actual set due to Friedrich and Kroenig).

TABLE XIX.

Depth	0	1	2	3	4	5	6	7	8	9	10
Intensity	100	89	87	77	69	60	51	47	42	37	31

According to these numbers the intensity of the beam at the tumor is 89 per cent that of the skin, or in any treatment, the skin receives 100/89 times the radiation received by the tumor. Now, suppose we cover the skin with a layer of say, paraffin wax, 8 cm. thick. In that case, the tumor is 9 cm. below the paraffin surface, the skin 8 cm. Since the paraffin wax absorbs much the same as tissue, it follows, from the numbers of Table XIX, that if the intensity at the paraffin surface is 100, at the skin it will be 42 per cent, at the tumor, 37 per cent. In other words, the intensity at the tumor is now 37/42 x 100 or 88 per cent of that at the skin,—a shade less than without this covering layer of paraffin. With such rays, therefore, there is no such advantage.

On the other hand, if one uses unfiltered rays of moderate penetration, such for example as are given in Table XX, there is some gain in this respect.

TABLE XX.

Depth	0	1	2	3	4	5	6	7	8	9	10
Intensity	100	81	65	53	43	35	29	24	19.4	15.9	13.1

Applying these numbers to the same supposed case, we find that with the covering layer of paraffin, the intensity at the tumor would be 15.9 / 19.4 or 82 per cent of the skin intensity,—a slight gain, but scarcely enough to justify the use of such a method unless there are other advantages. According to Morton, "central lesions are probably the easiest to treat with accuracy." In that case one advantage of using such a covering layer is found in the undoubted effect it has of changing a semi-superficial lesion into a central one.

DOSAGE IN DEEP THERAPY.

150. We pass now to a consideration of the actual dose delivered to the diseased area. How is it possible to measure the amount of radiant energy absorbed by a region within the human body? While in a few cases it is possible to insert a small ionization chamber right into a cavity (as has been done by Friedrich and Kroenig), from the nature of the problem, in most cases such direct measurements are out of the question. By the use of a phantom such as water, however, indirect measurements may be made. If, then, a radiologist wishes to know how much the intensity of a beam is reduced in passing through 8 cm. of tissue, he can do one of two things.

(1) By using some means of comparing intensities (preferably ionization) he can find by actual experiment the change in intensity which takes place when the ionization chamber, for example, is removed from a position on the surface of water to a point 8 cm. below. The percentage change found will correspond fairly closely to the change produced by 8 cm. of tissue,

since as already noted several times, the absorption of all kinds of rays by water is the same as by tissue.

(2) He can make use of standard charts, such as have been made by Dessauer, showing the variation in the intensity with increasing depth. For the intelligent use of either method, certain fundamental facts of great importance in deep therapy must be taken into consideration. These will now be briefly discussed.

151. Secondary radiation plays a part in deep therapy even more important than that of the primary beam. From what has been stated in Section 117, it should be evident that an object P (Fig. 110), placed within any scattering medium receives a radiation both from the primary beam from the target and from secondary rays originating from particles in the scattering medium which surrounds the object. That this is the case has been well shown by Friedrich and Kroenig. Two sets of readings were taken (1) with an ionization chamber placed as in Fig. 111 (a) so that by means of the lead diaphragm it received radiation from the primary beam directly, and (2) placed as in Fig. 111 (b), so that the chamber was screened from the primary beam but might receive secondary radiation from the dispersing medium through which the primary beam passed. Their readings showed that the intensity due to the secondary radiation could be as much as four times greater than that of the primary. In other words, the dose contributed by secondary rays in deep therapy may be as high as 80 per cent of the whole.

Now, some years ago, tables were published in which the intensity at various depths of tissue were given as a result of *calculation* based on the half absorption value of tissue and the law of the inverse square but without any consideration of the effect of scattered radiation. Such tables, therefore, are absolutely useless. To illustrate the point some measurements of Friedrich and Kroenig are again quoted. With a certain set-up, (that is, with rays of a certain effective wave-length), the intensity 10 cm. below the skin as calculated from a consideration of the above two factors, was 10 per cent of the surface intensity. By actual measurement with the ionization chamber the intensity at the same depth was 44 per cent of the skin value! Such tables, therefore, can only be obtained with any degree of accuracy by making actual measurements, if possible, with living tissue; failing that, in some suitable phantom such as water. Tables of this sort have been carefully made, notably by Dessauer, who has published charts from which the intensity at various depths may readily be obtained. In using these charts it must be remembered that the numbers will vary with the quality of the rays used, with the target distance, and with the size of the port of entry (see Section 152). A typical set, due to Glasser[7], is given in Table XXI where the numbers give the percentage intensity at the centre of a field, with port of entry 20 cm. x 20 cm.; 200,000 volts (crest) across tube; filter, 0.75 mm. copper + 1 mm. aluminum; target-skin distance 30 cm.; effective wave-length = 0.15 A. U.

TABLE XXI.

Distance:	0	2.0	3.2	4.6	6.0	7.8	10.0	12.8	17.0	cm.
Intensity:	100	90	80	70	60	50	40	30	20	

In connection with the use of even a good phantom such as water, it should not be forgotten that at the best no phantom can correspond exactly to highly complex tissue. While tissue in the main is composed of substances of low atomic weight, in the human body we have also to do with such elements as calcium and iron. It is possible, therefore, that characteristic rays from such substances may have an important therapeutic effect. "The therapeutic effect of x-rays often manifests itself pronouncedly in the proximity of bones. This is probably due in part to characteristic radiations emitted by the calcium and other constituents of the bones" (Kaye). In spite of such difficulties the use of phantoms permits of a standardized technique, as a result of which exact data may be accumulated. Correct physical doses, moreover, can be obtained even if all the factors taking part in the biological action are not known.

PORT OF ENTRY AND DEPTH DOSAGE.

152. In the use of such tables, it is highly important that all conditions conform to those for which the numbers have been given. With the effect of varying voltage, wave-length, filtration and target distance, the reader should now be fairly familiar: we have yet to show the effect of a change in the area of the port of entry. As secondary radiation is responsible for such a large fraction of the total depth dose, it should not be surprising to learn that the magnitude of the dose at any depth depends on the size of the cone of rays used. The reason is simple enough. A glance at Fig. 110, will show at once that the larger the volume radiated around the region P, the greater the number of particles there are to contribute secondary rays. This is borne out by actual measurement. Kroenig and Friedrich, for example, have shown that with a port of entry 12 cm. x 12 cm., the dose at a depth of 8 cm. in water is almost twice that obtained, at the same depth, with a port 4 cm. by 4 cm. The effect, of course, does not increase indefinitely with increase in port area, little increase being found beyond an area 20 cm. x 20 cm. (focal distance 30 cm.). The reason is obvious—there is a limit to the thickness of water which can be penetrated by the secondary rays.

Both the numbers of Table XXI, and the data of the last section, refer to the intensity of the radiation at points in the *center* of the field of radiation, that is, in Fig. 112, along the line FDM. It is not to be expected that the intensity at all points at the same depth, along the line ADB, for example, should be the same. At B (a point on the edge of the field of radiation) secondary rays will be received only from particles to the left, whereas at D secondary radiations are contributed by particles on all sides. The intensity at B, therefore, will in general be less than at D. For this reason the charts of Dessauer and Glasser, to which reference has already been made, consist of a series of curved lines, called "isodose" curves, formed by joining all points across the field for which the intensity of radiation is the same.

153. In making phantom measurements to find out the percentage depth dose, careful attention must be paid to another factor. This has to do with the position of the ionization chamber when readings are taken at the surface. The point may best be illustrated by referring to some measurements of Weatherwax and Leddy.[8] Using an ionization chamber only about 1 cm. in width (similar in size and style to that of Friedrich and Kroenig), these radiologists compared the intensities of a beam when the chamber was placed in several different positions near the surface. Their results are given in Table XXII.

TABLE XXII.

Position	Intensity
In air	66.4
On surface	95.7
Half submerged	98.5
Fully submerged	100.0
5 mm. below surface	97.7

NECESSITY OF STANDARDIZATION.

154. These results show the importance of specifying exactly the conditions under which measurements are made. There is a variation of over 4 per cent between positions when the chamber is just touching the water (95.7) and just submerged (100). Obviously the remedy for this and many other possible causes of errors lies in the adoption of a standard technique. Sooner or later international standards will be adopted in radiology as they have been done in all branches of science where measurements are necessary. In this respect good progress has already been made, as the writer has tried to show in dealing with the use of ionization chambers for the measurement of dosage. In the meantime, in every case of treatment published, it is important that conditions of operation should be given exactly—the quality of rays; tube current; tube voltage (accurately measured); filter; depth dose; target-skin distance; size of port; and so on. By this means cooperation between different workers is possible, and ultimate standardization is bound to come. Already much data has been accumulated—so much so that the particular percentage of an erythema dose which is correct for the treatment of different diseases is sometimes definitely stated. With such questions, however, it has not been the aim of the writer of these articles to deal; rather has he sought to explain something of the fundamental physical principles without a knowledge of which no sound advances in radiology are possible. A recent visit to one of the treatment rooms of a distinguished radiologist, Dr. E. Reginald Morton, a Canadian doctor practicing in London, England, gave very convincing evidence of how necessary such knowledge really is. In this room was to be seen a symmetrical coil apparatus, with mercury interrupter and valve spark gap, a water-cooled tube, with an automatic gas stabilizing device; an ionization outfit and a Seeman spectograph. For the intelligent use of such apparatus surely a sound knowledge of physical principles is essential.

FOOTNOTES:

1. Pfahler, Journal of Radiology, 4:225, July, 1923.
2. Friedrich and Kroenig, Radiation Therapy, Schmitz Translation, p. 59.
3. H. B. Gough, Phys. Soc. London, 35:4, 41 D, June, 1923.
4. Journal of Radiology, 4:335, Sept. 1923.
5. Groover, Christie and Merritt, Am. J. Roentgenol, 10:564, July, 1923. Montford Morrison, Bulletin of International X-Ray Corporation, 1923.
6. Some measurements recently reported by Dr. Berry (Phys. Soc. London, p. 26 D, June, 1923) seem to indicate that paraffin wax is more transparent than water.
7. Glasser, Am. J. Roentgenol, 10:405, May, 1923.
8. Weatherwax and Leddy, Am. J. Roentgenol, X, 6, 10:488, June, 1923.

EDITORIAL

The JOURNAL OF RADIOLOGY

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Unity the Watchword.

Unification of all agencies of physical methods in medicine is desirable, and the sound sense of this is admitted by all who have given the matter serious thought. Several existing societies have had this in mind more or less clearly but so hazy have been their ideas along this line that the constitutions of these organizations do not provide a workable plan. The prevailing scheme seems to be one which calls together the elect who have had long experience, to the exclusion of the younger man in science. There is no doubt about the wisdom and the need of having such men in every organization which expects to establish permanency but, on the other hand, encouragement should be given to those of younger years and less experience. In fact, the young man of today will be the man of ripe experience tomorrow and this condition is no less true in medical organizations than in governments.

It is true that older countries have discovered the x-ray and radium but American physicists, electrical engineers and clinicians have contributed much to the development and advancement of these phases of medical science. As proof of this statement one need only mention Mr. Clyde Snook, who produced the interrupterless transformer so commonly used today, as well as Dr. William D. Coolidge, whose tube has become practically universal in its use. This tube has made possible the employment of greatly simplified units working off ordinary lighting circuits, the tube itself rectifying the current. Together, these improvements have made the x-ray available as a diagnostic aid to practically every physician in the United States. The internist has his own diagnosis unit, the surgeon has his and the man in general practice has his equipment. These facts when correctly interpreted mean that a greater volume of work is being done each day by the men who are not and do not expect to be specialists in radiology.

The same condition is true regarding physiotherapy, phototherapy and electrotherapy. The man in general practice is putting this equipment into his office so that he may be better able to serve his patients. The patients come directly to these men so that much wider employment of physical methods is possible than with the specialist who has his patients assorted and classified before he sees them.

An organization, then, which will bind together all men interested in the physical agencies of medicine would seem to be demanded by popular need. It would seem that this organization should be all inclusive instead of exclusive. This means that membership should be made available to the specialist in any or all forms of physical medicine, to the man using these agencies as an aid to the practice of medicine or surgery, to the dentist interested enough to seek membership, to the physicist working for the advancement of these methods and to the technician who so ably carries on the detailed technique under proper supervision.

The older organizations upon the physical side of medicine have either been highly exclusive in their methods of operation, holding membership requirements so high that only the few could qualify, or they have gone to the other extreme and have thrown down the bars completely. Now that time has demonstrated the proper field for these methods in medicine, it would seem that a happy medium could be reached which would be satisfactory to all concerned. Luckily, the American Medical Association has tried the "inclusive" method long enough to prove the solidity of the plan. Certain requirements for membership have been worked out which reduce irregularity and unfair practices to the minimum. It would seem then that membership in the County Medical Society which is the fundamental unit of the American Medical Association, together with a few requirements fitted to the specialty under consideration, would be a satisfactory measure of the applicant for membership.

After due consideration of all these questions the constitution of the American College of Radiology and Physiotherapy was written. An attempt has been made in this constitution to meet the needs of the medical profession today. As time and conditions change the constitution can be changed to fit, but the underlying principles will probably alter but little, if any, during future years.

In order that all may become familiar with the working plan of the American College of Radiology and Physiotherapy, extracts from the constitution are printed herewith.

Objects

First: To alleviate human suffering and prolong human life by and through the study, promotion and scientific development of the sciences of Radiology and Physiotherapy and all other interrelated and interdependent sciences; to elevate the standards of Radiology and Physiotherapy; to establish standards of competency and of character for practitioners thereof; to provide a method for the granting of Fellowships in this college, and to give assurance to the medical profession and public at large that those persons elected to Fellowship in this College are worthy and properly qualified to engage in the practice of Radiology and Physiotherapy, as adjuncts of or aids to the sciences of medicine and dentistry.

Second: To sponsor and finance scientific research on such subjects and at such times as shall, in the judg-

ment of the officers of this corporation, seem imperative and fraught with beneficial possibilities viewed from the standpoint of the progress and development of the sciences of Radiology and Physiotherapy and the financial ability of this incorporation to successfully prosecute any such undertaking to a conclusion.

Third: To sponsor, promote and develop the American Registry of Radiological Technicians for the purpose of elevating the standards of lay technicians who may now or hereafter be working under competent medical and dental direction on the North American continent; for the purpose of safeguarding the interests of lay technicians so engaged and the interests of the medical and dental professions; and to eradicate by all educational and legal means the practice of these professions, or either of them, by members of the lay public independently and without competent medical or dental direction and supervision.

Fourth: To foster and promote the progress of the science of medicine generally, and the sciences of Radiology and Physiotherapy and all allied sciences particularly, by widespread dissemination of knowledge concerning the fundamentals which underlie these sciences, as a part of the social and economic fabric; to facilitate and insure the correct application and use of these sciences in the interest of the public health; and to acquaint the medical and dental professions at large, together with such members of the lay public as may be interested therein, with the activities and ideals of the American College of Radiology and Physiotherapy.

Fifth: To provide for the proper and businesslike administration of all bequests, endowments, gifts, and such other sums of money or property as may be tendered the American College of Radiology and Physiotherapy for the advancement of its own activities and the promotion and development of the sciences of Radiology and Physiotherapy and allied sciences.

Sixth: To provide a necessary, proper and efficient agency for the coordination and correlation of the activities of all other organizations devoted to or seeking the promotion or advancement of the sciences of Radiology and Physiotherapy and allied sciences, and the promotion and preservation of the welfare of such organizations in harmony with the ideals and purposes of the American College of Radiology and Physiotherapy.

Seventh: To conduct a school or schools, a college or colleges, wherein proper courses shall be given to those desiring postgraduate or undergraduate instruction in the medical, dental and commercial application of the science of Radiology and Physiotherapy and allied sciences.

III
Fellows

Section 1. The Fellows of the College shall be graduates in medicine and dentistry who are licensed to practice their professions in their respective states and provinces, or medical or dental officers of the Federal Service, who have made application for Fellowship (such application being endorsed by three Fellows of the College, one of whom shall be a member of the Board of Governors), who meet the qualifications and requirements that shall from time to time be established, and who shall be elected to Fellowship by the Board of Governors on recommendation of the Committee of Credentials.

Section 2. Each individual elected to Fellowship in the College shall be designated as a "Fellow of the American College of Radiology and Physiotherapy," and shall be authorized and encouraged to use the insignia of the organization and the letters "F. A. C. R. P." after his name on professional cards, in professional directories and in articles published in medical literature.

IV.
Associate Fellows

Members of the American Physical Society interested in the sciences of Radiology and Physiotherapy and such other recognized physicists as devote a major portion of their time to the scientific investigation of these subjects, may be elected to Associate Fellowship in the College with all the rights and benefits of membership therein, save only the one of holding office.

V.
Sections of the College

Section 1. Dental Section: Whenever one hundred (100) Fellows of the College who are engaged in the practice of dental science or dental radiography make written application therefor directed to the Board of Governors of the College, the Board of Governors shall authorize the creation of a Section for the study of subjects peculiarly interesting to these individuals. Upon the creation of a Dental Section, the members of the College falling in that class shall select one of their number who shall act as Chairman and another who shall act as Vice-Chairman. The Chairman shall have power to appoint such committees as are needful in the conduct of the Section, with all possible latitude in the arrangement of scientific sessions not inimical to the welfare of the College nor in contravention of its declared purposes and objects. The annual meeting of the Section shall be held at the same time and place as the annual meeting of the College proper, so that full interchange of scientific discussion and courtesies may be had.

Section 2. Technician's Section: Whenever one hundred (100) licensed Technicians of the American Registry of Radiological Technicians shall make written application therefor directed to the Board of Governors, the Board of Governors shall authorize the creation of a Technician's Section of the College. This Section shall have a Chairman appointed annually from among the Fellows of the College and a Vice-Chairman elected from the group of Technicians by their own vote. In this Section the Vice-Chairman shall perform all the duties of the Chairman in the arrangement of programs and in the conduct of the Section subject to the supervision of the Chairman, whose duty it shall be to see that the best interests of the College, the medical and dental professions, and the Technicians are conserved, and in keeping with the avowed ideals of the College. The annual meeting of the Section of Technicians shall be held at the same time and place as the annual meeting of the College, so that full intrchange of ideas may be had and general discussion of the problems of the Technicians may be indulged.

From the above recitation of the purposes of this organization and the requirements for membership, it will be seen that the highest ideals are held and that the "inclusive" scheme of organization has been provided in such a manner as to be workable and yet sufficiently safeguarded. It will also be observed that the College *does not seek to replace* any organization already in existence but on the other hand seeks to unify all such organizations, making one grand union of all phases of American radiology and physiotherapy. As proof of this statement another extract from the constitution of the American College of Radiology and Physiotherapy is copied.

II.

BOARD OF GOVERNORS

Section 2. The original Board of Governors shall be divided by lot into three classes to serve one, two and three years respectively. At the annual meeting in 1924 and at the annual meeting each year thereafter, the Fellows of the College shall elect from their number fifty (50) Radiologists and Physiotherapists to membership on the Board of Governors, each to serve for the term of three (3) years; thirty (30) of these members are to be elected from a list of nominations consisting of three (3) members each nominated by the following Radiological and Physiotherapeutic Associations and Societies of North America, including one each from the United States Army and the United States Navy:

(1) The American Electrotherapeutical Association
(2) The American Radium Society
(3) The American Roentgen Ray Society
(4) The Canadian Radiological Society
(5) The Radiological Society of North America
(6) The Central Electrotherapeutic Society
(7) The Central Illinois Radiological Society
(8) The Chicago Roentgen Ray Society
(9) The Detroit Radium and X-Ray Society
(10) The Iowa State Radiological and Physiotherapy Society
(11) The Iowa X-Ray Club
(12) The Missouri Radiological Society
(13) The Nebraska Society of Radiology and Physiotherapy
(14) The New England Association for Physical Therapeutics
(15) The New England Roentgen Ray Society
(16) The New York Electrotherapeutic Society
(17) The New York Roentgen Ray Society
(18) The Pacific Coast Roentgen Ray Society
(19) The Philadelphia Roentgen Ray Society
(20) The Roentgen Ray Society of Central Pennsylvania
(21) The South Dakota Radiological and Physiotherapy Society
(22) The Utah Society of Radiology and Physiotherapy
(23) The Western Electrotherapeutic Association
(24) The Milwaukee X-Ray Club
(25) The American Physical Society
(26) American Society of Dental Radiographers

Like recognition will be accorded all other proper organizations by the Board of Governors of the College upon presentation to it of appropriate credentials.

Twenty (20) members shall be elected at large to represent Radiologists and Physiotherapists of North America not affiliated with the above Societies or Associations. In cases of the failure of any of the above named organizations to make its quota of nominess, or in case of duplication of nominees, the Board of Governors then in existence shall nominate members from among the Fellows at large to fill the vacancies in the list of nominees. The Board of Governors shall have the power to elect from the Fellows of the College members to fill all vacancies in the current membership of the Board of Governors due to death, resignation or other causes.

This is ample proof, it would appear, that the founders of the American College of Radiology and Physiotherapy had only the highest good of the medical profession as a whole and physiotherapy, in particular, at heart. The purpose is unification of all branches of physical medicine and to that end all existing organizations are invited and urged to elect representatives from the central Board of Governors who shall, in turn, administer the affairs of the American College of Radiology and Physiotherapy. Hearty cooperation of all organizations will accomplish great things. Already applications for membership have been received in unexpected numbers. Among these are members of the American College of Surgeons, American College of Physicians, American Medical Association, American Roentgen Ray Society, Radiological Society of North America and many other well known organizations.

Western Electrotherapeutic Association.

The sixth annual meeting of this organization will be held in the Little Theatre, Kansas City, Mo., Thursday and Friday, April 17th and 18th, under the presidency of Harry H. Bowing, M. D., of Rochester, Minn. A cordial invitation is extended to the medical profession of nearby states.

The preliminary program has been announced as follows:

"Clinical and Histological Observations in the Treatment of Neoplastic Diseases." William L. Clark, M. D., Philadelphia.

"The Pathology, Diagnosis and Treatment of Skin Diseases." C. D. Collins, M. D., Chicago.

"Coagulation Essentials." T. Howard Plank, M. D., Chicago.

"Electrocoagulation in Cancer of the Uterus." A. David Wilmoth, M. D., Louisville, Ky.

"What the European Clinics Think of High Frequency Currents." Joseph E. G. Waddington, M. D., Detroit.

"The Use of Physiotherapy in the Reconstruction of the Industrial Injured." James E. M. Thomson, M. D., Lincoln, Nebr.

"The Physiotherapeutic Treatment of Colitis." Curran Pope, M. D., Louisville, Ky.

"The Use of the Cobalt Blue Lens with Ultraviolet Therapy in the Treatment of Luetic Ulcers." Emma Leah Stewart, Louisville, Ky.

"Radium." Sanford Withers, M. D., Denver.

"Blood Pressure Interpretations." Burton B. Grover, M. D., Colorado Springs.

Title to Be Announced. Roy W. Fouts, Omaha.

"Bright's Disease Treated by High Frequency Currents." Omar T. Cruikshank, M. D., Pittsburgh.

Title to Be Announced. E. H. Skinner, M. D., Kansas City, Mo.

Dr. William L. Clark and Dr. T. Howard Plank will hold an operative clinic at General Hospital on Friday.

On Tuesday evening, April 15th, there will be a joint meeting with the Jackson County Medical Society. Papers will be presented by Drs. Clark and Bowing.

American Radium Society.

The American Radium Society will meet in Chicago on Monday and Tuesday, June 9th and 10th, in connection with the American Medical Association. Any contributions to the program should be sent at once to the Chairman of the Program Committee, Dr. George E. Pfahler, 1321 Spruce St., Philadelphia.

Pennsylvania Journal of Roentgenology.

In the January issue of the Journal of Radiology, in the Department of Technique, page 24, there appeared a number of practical hints upon office technique. Some of these should have been credited to the Pennsylvania Journal of Roentgenology, but through an unfortunate and unintentional oversight this credit was omitted.

Research Prize Awarded.

Dr. Johannes Fibiger of the University of Copenhagen has been awarded the Sofie A. Nordhoff-Jung Cancer Prize for his work in cancer research, a well known work which has definitely demonstrated that parasites play an important part in the formation of certain types of animal-tumors. Dr. Fibiger was also the first to successfully induce a malignant growth by means of external irritations.

Courses in Radiation Therapy.

Dr. Albert Bachem in collaboration with clinicians especially familiar with radiology is giving a series of courses in radiation therapy in Chicago. Each course extends over a period of two weeks and will cover the physical and biological as well as the technical side of radiation therapy. Different types of deep therapy x-ray generators and of measuring instruments will be used in demonstrating the various methods of intensity and hardness measurements. The first course opened Monday, March 3rd. The second course, covering the same ground, will open Monday, April 7th, and the third course will begin on Monday, May 5th. Full information may be obtained by addressing Dr. Bachem at 502 Oakwood Blvd., Chicago.

Cancer.

The editorial office is in receipt of the January number of the new Journal, "Cancer" which is edited by L. Duncan Bulkley, M. D., and Clarence D. Daniels, M. D., with Drs. Appel, Little, Kelsey, Preble and Stedman as collaborators.

"Cancer" is intended, says Dr. Bulkley, "to furnish to the general physician, surgeon and specialist, a knowledge of cancer as a disease and the best manner of handling it. While committed largely to the consideration of the systemic or constitutional aspect of true cancer, or carcinosis, its pages are freely open to any and all methods of treatment, which can be shown to be in the best interests of cancer, and such articles, surgical and other, are solicited. Cutaneous epithelioma, being pretty well understood and successfully treated by local measures, hardly belongs to this Journal."

Abstracts from "Cancer" will appear in the April issue of the Journal of Radiology.

Ontario Dental Association.

The annual convention of the Ontario Dental Society will be held at the King Edward Hotel, Toronto, May 26th and 27th, 1924. An excellent program has been arranged and a record attendance is already assured.

CASE REPORTS

A Case Report of Unusual Genito-Urinary Disease

W. S. ROBERTSON, M. D., and
C. R. MADDEN
Director of Laboratories, Kanawha Valley Hospital,
Charleston, W. Va.

MRS. S. WHITE: Age 30, has two children, ages 3 and 5. Has had attacks of abdominal pain beginning in her first pregnancy. Frequency of urination at times. After first delivery, diagnosis of appendicitis was made and appendix was removed in 1919 with no improvement in symptoms. Her second pregnancy was accompanied by a great deal of bladder distress and severe pains in right flank and in upper right abdomen. These symptoms were somewhat improved after delivery but she was never entirely free from discomfort. At times the attacks were very severe and a diagnosis of cholelithiasis was made. She was operated upon for this condition October 7th, 1923. No gall stones were found but she was informed by her surgeon that there were many adhesions around the gall bladder. She remained in the hospital for four weeks, having the same attacks from which she had suffered for several years.

This patient was first seen December 6th, 1923. The urine was found to be loaded with pus; a urologic investigation was advised. The left kidney and ureter were found to be normal, the right side presented a well defined ureteral stricture, a kinked hydro-ureter, and a moderately dilated and infected pelvis. The function of the right kidney was 7 per cent against 35 per cent of the left. She was five months pregnant, much emaciated and there was a question as to whether a nephrectomy should be performed or labor induced. It was believed that the kidney would eventually have to be removed whether or not the uterus was emptied. Therefore a nephrectomy was done December 8th. The patient is at this time, January 15th, up and around and except for normal pressure symptoms incident to her pregnancy, is comfortable.

This case is of unusual interest to the radiologist because of the extreme angle in the ureter. The radiographs were taken stereoscopically and when examined showed a complete loop in the ureter. It will be noted in the accompanying illustration that there are two distinct strictures of the ureter, one at the brim of the pelvis, the other about five centimeters higher where the ureter makes the loop.

The removed kidney was slightly larger than normal, the pelvis much dilated and infected, the pyramids short and compressed, the cortex very thin. There were two moderately large infarcts in the cortex of the lower poll.

ABSTRACTS and REVIEWS

Statistics and Technique in the Treatment of Prostatic Hypertrophy by Means of Radiation Therapy. J. T. STEVENS, M. D., Pennsylvania J. Roentgenol. 4:20-24, October, 1923.

THE author says if his results in a series of cases detailed in his paper can be duplicated in the majority of cases coming to him for treatment of simple hypertrophy of the prostrate then radiation therapy of these cases is justifiable. In proper hands there is no danger from the treatment, there being no loss of voluntary control of the bladder, nor injury to the rectum, nor persistent urinary fistula. Complicating conditions are usually no contra-indication to radiation therapy. There is no attendant shock, hemorrhage, bronchitis, septicemia nor pulmonary embolism and no mortality that can be traced to the treatments. Surgery can be substituted if radiation fails, as radiation does not produce any condition to interfere with it, in fact the gland can be removed with much less hemorrhage.

X-Ray of the Kidney After the Injection of Opaque Media. B. H. NICHOLS, M. D., Pennsylvania Journal of Roentgenol. 4:6-10, October, 1923.

GENERAL Perspective: The kidney pelves and the major calices may assume a great variety of shapes and sizes in different individuals. The capacity of the pelvis is usually greater than that of the calices combined, although in some cases it is smaller. If the pelvis is large there is usually not a corresponding enlargement of the calices, but if it is small the calices are usually small also. Normally the capacity of the pelvis is the same in both kidneys but this is not always true. Normally the kidney pelvis extends downward and somewhat toward the spine, but in rotation of the kidney this position may be reversed. The major calices are usually three in number but there may be two or four, and a calyx is sometimes divided into two or more divisions. Roentgenograms will often show an apparent anastomosis of the major calices but often this is due to superimposing shadows of the injected calices. The minor calices, somewhat pyramidal in appearance are formed by the projection of the minor papillae into the ends of the calices, their bases having a cup-shaped appearance but in the roentgenogram the end-view of these may produce a rounded dense shadow not unlike calculus in appearance.

Normal Suspension and Fixation: The kidney is held in position by the adipose capsule, renal fascia and the intra-abdominal pressure of the neighboring viscera. The ureter is supported independently of the kidney by its fixation anteriorly to the surface of the peritoneum. This is important to note in the consideration of displaced kidneys with kinks in the ureter as a causative factor of hydronephrosis.

Abnormalities demonstrable by roentgenography are (1) duplication of the renal pelvis; (2) dystopic or pelvis kidney; (3) double or bifurcated ureter; (4) fused or horseshoe kidney; (5) congenital increase or decrease in size of kidney pelvis.

Acquired abnormal conditions are renal mobility, resulting in movable kidney; renal torsion; pelvis kidney; aberrant vessels not demonstrable by x-ray examination.

Active etiological factors are infection (commonly colon bacillus or tuberculosis), and trauma. Long continued colon bacillus infection produces renal mobility, hence sagging, hence obstruction of urine and dilatation of the pelvis. Tuberculosis usually produces dilatation of the pelvis; cortical necrosis and stricture of the ureter produces obstruction with dilatation. Braasch describes the irregular outline of the kidney pelvis which often results from tuberculosis as appearing moth eaten.

Direct etiological factors are tumor, stone, stricture (giving obstruction), motor insufficiency with patent ureterovesical orifice, and central nerve crises.

Essential technique must be properly carried out. In early cases a preliminary x-ray study should be made of the genito-urinary tract befort injection. All residual urine must be drained from the pelvis as the injection must completely fill both pelvis and calices. During exposure of films, of course, the patient must remain motionless. It is wise to take lateral plates also.

Dilatation of the ureter below a calculus is due either to infection or a calculus passed. However, dilatation of the ureter may be the result of unusual elasticity of the ureteral wall and may be perfectly normal. Angulation and kinks in the ureter may be due to kidney mobility. Because of the independent fixation of the ureter it does not descend with the kidney. Such conditions as these, however, cannot be considered pathological unless pathological changes resulting from obstruction can be seen in the kidney pelvis.

If the kidney pelvis has a capacity of 20 to 25 c. c., there is usually a hydronephrosis present but some normal kidneys will dilate to this extent so the sign is not absolute. This author claims that unless injection is continued to the point of discomfort from pressure the filling of the pelvis is uncertain. It cannot be properly ascertained by the fluoroscope.

The first indication of hydronephrotic changes as shown by the pyelogram is a dimness of outline and inflation of the minor calices, which should appear in the terminal projections of more than one of the major calices. The next change is a widening of the bases of major calices giving the "plug-hat" calyx. Enlargement of the kidney pelvis follows, then the major calices widen throughout, the minor ones disappear, the angle formed by the ureter at its entrance to the pelvis becomes more acute and the pelvis more dilated. These are the changes of prime importance in the early diagnosis of hydronephrosis. In advanced cases diagnosis can usually be established by a cystoscopic examination with catheterization of the ureter but a pyelogram may be necessary. In advanced cases the changes are (1) extensive dilatation of pelvis; (2) rounded individual areas and dim areas suggesting diluted fluid; (3) major calices broadened and shortened until they may present only a narrow indenture of the hydronephrotic sac.

A calculus in the kidney pelvis which does not show on an ordinary plate because its consistency is such as to cause no contrast, may be re-

cognized on the pyelogram by the presence of an area of lesser density in the shadow of the injected media at the point occupied by the calculus. Tumors frequently compress the pelvis in a most characteristic manner.

"If we are satisfied that the kidney pelvis has been properly filled and one or more pyelograms have been properly made; if the history has been taken carefully and all potential etiological factors have been considered, then in the presence of positive findings we may with reasonable assurance make a diagnosis. A negative finding is not necessarily indicative of the absence of the disease, however, as intermittent hydronephrosis may be present."

Roentgen Ray and Radium Therapy of Hypertrophied Prostates. HERMAN B. PHILLIPS, M. D., New York M. J. & M. R. 118:272-275, Sept. 5, 1923.

TWENTY-FIVE cases of hypertrophied prostates were treated by this author and his conclusion is that this condition should no longer be considered an absolutely surgical one.

Technique Used: Four areas three inches square are marked off on the lower abdomen and over each groin, centering about the symphysis pubis. Four more areas, posteriorly over the region of the tip of the coccyx, were marked off and all were arranged for crossfire radiation of the prostate gland. Each area is treated successively with 75 ma. min., 9 inch backup, 12 inch distance, 4 mm. Al filter. After this an intrarectal application of 100 to 200 mg. hrs. of radium through a brass and rubber filter is given, cross firing on the prostate. About two weeks time is consumed for this round of treatment. This is followed by two weeks rest. Three rounds of treatment produce sufficient involution of the gland to accomplish complete symptomatic relief so that in practically every case the patient is completely relieved of obstructive symptoms at the end of three months. In uncomplicated cases definite improvement will be noted in three to four weeks. The usual treatment for cystitis, vesical tenesmus, etc., was carried out until with the establishment of better drainage they were gradually disposed of.

It is important to note that malignant cases must be excluded from this treatment for the effect would certainly stimulate the growth.

Results Obtained by Various Methods in the Treatment of Tumors of the Bladder. HUGH H. YOUNG, M. D., New York M. J. & M. R. 118:262-268, Sept. 5, 1923.

A REVIEW of 380 cases forms the basis of this report. The author's concluding paragraph says: "Viewed as a whole, however, the gloomy outlook which was held as to the curability of bladder tumors has passed. Fulguration, radium, the electrocautery and careful radical resection have transformed the situation so that now about 95 per cent of the benign and 75 per cent of the malignant papillomata, about 50 per cent of papillary carcinomata and somewhere near 25 per cent of the infiltrating carcinomata are probably curable by one or more of the methods above referred to."

Urography. B. H. NICHOLS, M. D., New York M. J. & M. R. 118-492-494, Oct. 17, 1923.

THE TECHNIQUE of a genito-urinary examination is difficult and requires the cooperation of a trained urologist. Every x-ray laboratory should be thoroughly equipped to do this type of examination. The roentgenologist should know not only the terminology of lesions of the urinary tract but he should be thoroughly informed on the significance of the history, laboratory findings and clinical picture of every case coming to him.

A request for an x-ray examination of the genito-urinary tract to determine the presence or absence of stones should be met, just as in a gastro-intestinal examination, with a thorough search for other pathology. However, examination by the opaque solution is not always necessary, e. g., a suspicious shadow on a roentgenogram may be due to a wart, scar, gall-stone, calcified gland or costal cartilage, previous injection of bismuth, silver salts, etc., or to phleboliths or foreign bodies, pills, enteroliths, retained barium or inspissated pus in tubes. Two plates of the same area should always be taken in order to rule out any artefact in the plate.

Another group of cases, those in which no suspicious shadow is seen, is not so easily disposed of. These offer too broad a field for discussion in a brief paper so the author stops to consider only a few of them.

He again warns his readers that the injection of an opaque solution into the genito-urinary tract should be done only by one who is familiar with the technique and with the specific dangers of the procedure. He particularly stresses the danger of injecting more than one side at a single examination.

Massive Neoplasm of the Lung with Paralysis of the Diaphragm. J. HENRY SCHROEDER, M. D., New York M. J. & M. R. 118:628-630, Nov. 21, 1923.

THIS PAPER reports a case with direct diagnosis of neoplasm of the lung with secondary paralysis of the diaphragm on the involved side. The patient was otherwise in good physical condition and irradiation was undertaken.

One large area of entrance anteriorly and one posteriorly was used, corresponding to the involved area. The minimum carcinoma dose of Wintz (100 per cent of surface erythema dose), was used, ultrahard roentgen rays at 200,000 volts maximum was given in one treatment, and seven days later an additional dose of 30 per cent of the carcinoma dose was given through another area.

The subsequent systemic effect was mild. There was increased cough and tightness of the chest which subsided in a week, and six weeks later the patient's physician reported that the patient was much improved in general health and strength and that there was no longer any cough. Two months after the first treatment a second treatment was given and five months' later x-ray examination showed no tumor. Connective tissue proliferation had occurred but not as a pathological fibrosis. One year after the last irradiation the patient's condition remains excellent.

Deep Roentgen Therapy of Neoplastic Pulmonary Metastases. WM. A. EVANS, M. D. and T. LEUCUTIA, M. D., Am. J. Roentgenol. 10:35-49, January, 1924.

IN ALL METASTATIC malignancies of the chest where there are no metastases elsewhere in the body, deep ray therapy is indicated. Normal lung tissue will show an increasing sensitivenss toward repeated irradiation but the tumor tissue will, as a rule show a decreasing sensitiveness toward it.

"In the treatment of metastatic sarcomata, the morphological and the histogenetic structure of the tumor play a very important part. Best results are obtained in the embryonal type of sarcomatas (angiosarcomata) while the fibroblastic adult type of tumors, especially when rich in paraplastic structures, are refractory to radiation. The nearer the sarcomata come to the undifferentiated embryonal type, the better chance for suc-

cess, and the nearer they are to the adult tumors rich in paraplastic structure, the less the chance for success.

"In the treatment of metastatic carcinomata, the circumscribed mediastinal metastases and the infiltrating lymphangetic metastases respond well to treatment, especially when the primary carcinoma is of the differentiated type. The miliary metastases of the carcinoma if localized, respond well to the treatment, but if they are generalized the prognosis is very grave.

"Complications may arise incident to the treatment of all metastatic processes of the lungs: (a) hemorrhage of the lungs; (b) rupture of the lung, with following pneumothorax; (c) changes in the normal lung tissue.

"If the dosage is not exceeded or if there is only one exposure, the lung changes are of only temporary character, that is, infiltration of the lungs; but, if the dosage is exceeded, and the irradiation is several times repeated, the changes may be permanent fibrosis of the lungs.

"When treating malignant metastases of the lungs, the necessary biological dosage of radiation should be administered to the tumor tissue itself, but at the same time, the normal lung tissue should be protected from all damaging results from the radiation. Therefore, attempt should be made to eradicate the disease in one single treatment. Only if this is impossible should the treatment be repeated. Never should a third or fourth irradiation be applied to both lung fields.

"General stimulation of the protective forces of the organism should be an indispensable part of deep roentgen treatment.

"No statement can be made regarding the final outcome of these diseases, our observations being limited to a period of one and one-half years.

"The question of a sarcoma or carcinoma immunity is seriously to be considered. The future application of deep roentgentherapy will probably develop along these lines."

X-Ray Examination of the Colon by Means of the Barium Enema. LEON J. MENVILLE, M. D., New Orleans, M. and S. J., 76:284-285, December 1923.

THE VALUE of the barium enema is well attested in the best clincs.

In preparation the colon should be entirely emptied by means of two ounces of castor oil given the night before, patient abstaining from dinner and breakfast. Several water enemas should be given in the morning until the water returns clear.

The barium enema is made of 8 ounces of barium sulphate, 16 of mucilage of acacia, with two or three cans of unsweetened condensed milk, the whole making about 50 to 60 fluid ounces. A normal colon will fill with from 40 to 50 fluid ounces and there is no necessity for the knee chest position, patient may lie upon the back. Fluoroscopic examination by palpation is of first importance but plates should also be taken.

A normal colon is closely fixed at the hepatic, splenic flexure and at the rectum, while the parts between are loose and assume various positions. In an abnormal colon there may be ptosis of portions and the hepatic flexure occasionally may be found low, but the splenic flexure rarely changes position. Any part of the colon may be displaced by extrinsic tumors of the kidney, liver, pancreas, spleen, uterus and adnexa, adhesions, pregnancy and psoas abscess. The normal colon is of increased length, usually most marked in the sigmoid and transverse parts.

In cancer of the colon a filling defect with a corresponding palpable mass is of great value in making the examination, but benign tumor, polypus, syphilis, actinomycosis and cicatrical stricture from ulcer may give the same findings and must be ruled out by means of the clinical picture before diagnosis of cancer is given.

In diverticulitis of the colon the percentage of correct diagnosis is greater by means of the roentgen ray than by any other means.

Tuberculosis of the colon is oftenest found in the cecum and ascending colon. Filling defects and absence of barium at the site of the disease (due to alterations in the wall of the bowel and to spastic condition) are found with this disease but there are similar findings in cancer and ulceratives colitis of the colon. However, these findings are characteristic of tuberculosis and should lead to a search elsewhere in the patient's body for evidence of the disease.

In chronic ulcerative colitis the barium enema x-ray examination shows a rapid filling of the bowel, walls smooth and free from haustration, lumen narrowed.

X-ray diagnosis of obstruction and Hirschsprung's disease is not difficult and that of fistula is greatly aided by means of the x-ray.

X-Ray Treatment of the Skin and Its Appendages. F. J. STANSFIELD, M. R. C. S., R. C. P., M. J. Australia, 2:217-229, Sept. 1, 1923.

THIS AUTHOR names as amenable to x-ray treatment the following lesions: Psoriasis (temporarily benefited), mycosis fungoides, lupus erythematosus and lupus vulgaris (photo-therapy better), acne vulgaris, sycosis vulgaris and acne varioliformis. Tinea tonsurans is satisfactorily handled if proper technique is employed but this lesion provides a pitfall for the roentgenologist since permanent baldness and also x-ray burns are common sequelae if technique is at fault. Vascular nevi are amenable but the superficial "port wine stain" is the most difficult to remove. Corns, callouses and warts disappear under x-ray treatment and the author also cites success in treating pruritis.

In skin cancers there is a great variation in response to treatment. Basal-cell epithelioma is very successfully treated by x-rays and this author would use them for this type in preference to any other form of treatment. The subject of the treatment of eczema is gone into at some length, the nine classes being discussed and the discussion is summed up by saying: "As a general proposition, both in localized and generalized acute erythematous eczema, irradiation is contra-indicated in the early stage of evolution. If the eruption persists and becomes pruritic, exudative or squamous then x-ray treatment is certainly indicated and excellent results may be expected." Lichen planus is greatly benefited by x-ray treatment and usually is cured thereby. Hyperhidrosis, chelitis exfoliativa and rhinoscleroma are two other lesions amenable to roentgenotherapy.

Roentgen Ray Treatment of Eczema. WILLIAM J. MACDONALD, M. D. Boston M. & S. J. 189:926-928, Dec. 6, 1923.

THE AUTHOR refers to eczema and not to epidermophytosis or any of the mycotic diseases. Suitable local treatment, diet and rest will usually clear up a local eczema but the local treatment should be supplemented by x-ray which offers a rapid, clean and tolerably certain cure in most cases. Carbohydrate excess and eczema are mutually related so correct dietary treatment is essential. Cutaneous roentgenology is best undertaken by the dermatologist who can interpret the progress of the disease better than can the roentgenologist.

Basal Cell Carcinoma. HARRY E. BLASDELL, M. D., J. Kansas M. Soc. 23: 338-341, December, 1923.

EARLY RECOGNITION of and prompt treatment of basal-cell carcinoma will save a great many lives and prevent many unsightly deformities. It is a sad fact that although this type of carcinoma is probably the most benign and offers the greatest hope of cure of any form of cancer there are always to be found a great number of alarming cases of this lesion which have been under treatment by a family physician, perhaps for years, who did not understand the nature of the lesion.

In this paper rodent ulcer and basal-cell carcinoma are considered as one and the same lesion as distinguished from the older classification included under the general name of epithelioma.

The new growth commences at the site of a seborrheic patch or senile keratosis and is composed of cells that are smaller and that have deeper staining nuclei than the surrounding basement layer. They soon bulge into the corium and at times the down growing strands are numerous and varied and in other specimens show only one single downward proliferation. Most of them occur above the mouth line. They do not occur at edge of epithelial tissue. Growth is very slow and if it is removed in its entirety will not return. Aims at prevention of this lesion must be directed toward the precancerous condition and the early case. They may arise from moles, scars, seborrheic keratosis or senile keratosis, first appearing as a small crust, removal of which results in temporary healing. The next stage is that of a papule which may continue for many years constantly crusting over, then spreading peripherally to form an ulcer with hard rolled edges and shallow base. The button-like edge is the most positive diagnosis of a basal-cell carcinoma. Syphilis simulates the growth at times but syphilitic lesions have a greater discharge and are more purulent in nature. Lupus vulgaris can also be confused with basal-cell carcinoma but here the involvement of the surrounding tissue will denote the differentiation.

As to treatment, plaster, the cautery, the soldering iron, scalpel, carbon dioxide snow, telotherm, x-ray and radium have all been used with good success but the scarring effects of some of these agencies have led to the greater use of x-ray and radium in treatments. The use of radium in unskilled hands is dangerous and previous use of either x-ray or radium, according to McKee's opinion, prohibits its second use if the first treatment has been unsuccessfully done. The author favors the use of the electric cautery. No one method can be relied upon in every case but complete removal of the growth is the essential factor in whatever treatment is used.

The Treatment of Precancerous and Cancerous Lesions in the Mouth. WILLIAM H. SCHMIDT, M. D., New York M. J. & M. R. 118:732-737, Dec. 19, 1923.

THE AUTHOR lists leukoplakia, ulcer and angiomata as precancerous. Leukoplakia may develop very rapidly or it may take months and years to develop. Rough or diseased teeth and the habit of chewing tobacco, also pyorrhea and tartar around the teeth, are all held to be contributing factors. The earliest indication of leukoplakia is an inflamed mucous membrane with secondary hyperkeratosis. At first only a small white patch is seen and later this spreads and becomes indurated. The dental conditions should be remedied and the use of tobacco interdicted. This will clear up many cases but others will require further treatment. Antisyphilitic treatment is useless. Radium is good in certain cases but the technique must be very exact. Roentgen ray treatment is difficult and usually is useless for these cases. Destructive treatment is best. The actual cautery is not so good as the high frequency current which the author regards as ideal. Currents of varying voltage and amperage are used, depending upon the particular case.

Ulcers may be simple, tuberculous, syphilitic or malignant. Any ulcer of the oral cavity of two weeks duration which refuses to heal after irritation has been removed should be regarded with suspicion. A simple ulcer will heal readily, a tuberculous ulcer will heal slowly if at all. A syphilitic ulcer bears a very close resemblance to cancer and differential diagnosis is important. If syphilitic, it will promptly respond to antisyphilitic treatment. Taking a section for examination is condemned. Total eradication by electrocoagulation is the author's choice of treatment if the ulcer is in question. This should be combined with antisyphilitic treatment if the ulcer is syphilitic, or thought to be. He believes that syphilis acts as an indirect agent in preparing the tissue for malignant degeneration.

Angiomata may exist for years and cause no trouble but if subject to continued trauma malignancy may develop. The same is true of a simple papilloma or a salivary calculus, though not of such frequent occurrence.

In oral cancer it is not the local lesion but metastases from it to the glands which produce fatal results.

In cancer of the tongue radium is of strictly limited value. Surface applications are dangerous. However, imbedded radium followed by electrothermic coagulation about a week after the radium treatment and before the radium reaction has set in in full force, may be used. X-ray is useless here. The author prefers electrathermic coagulation to either surgery or radium. The advantages are the absence of bleeding or shock, infection or postoperative pain and at the end of two or three weeks it can be repeated until the whole local lesion is destroyed and any diseased area remaining can be treated at once. Every case, whether the glands are enlarged or not, is thoroughly radiated each side of the neck.

Cancer of the alveolus usually begins around a decayed or a rough tooth; the jaw bone should be x-rayed in all such cases. Only the margin may be involved or the disease may extend half way through the bone. Early treatment is most important. Electrothermic treatment has an advantage over surgery in that it may be used to destroy the diseased soft tissues and only the part of the bone which is diseased, leaving the healthy bone to maintain the outline of the jaw.

In epulis, electrothermy is most valuable whether the epulis be of the hard fibrous type or the soft vascular type.

Cancer of the floor of the mouth is usually secondary to cancer of the tongue or the alveolus. It starts as an indurated ulcer. It is a serious lesion and surgery is not very useful for it. The current is used to destroy all diseased tissue which is then curetted away and radium needles are inserted. Attention to the glands is important, and this statement applies in all oral lesions.

Cancer of the cheek: This may be destroyed by the current without going through the cheek. Radium treatment is given the glands.

Cancer of the antrum: Here very frequently the contour of the face may be preserved by use of the electrothermic method.

Cancer of the lower lip: Here the patient has greater forewarning than in any other form of cancer of the mouth, but neglect is shockingly fre-

quent. A combination of the electrothermic method, radium and x-ray will cure a large percentage of cancers of the lip if the glands are not involved, and if the glands are involved will give far better results than will any other form of treatment.

In general, the removal of precancerous lesions of the mouth is the most important factor in the fight and early and proper treatment is essential for success. No one method should be used for all cases but a proper selection should be made for the individual case. Many cases previously thought hopeless are now found amenable to surgery, x-ray, radium and the electrothermic method, either singly or in combination.

The Diagnosis and Treatment of Hyperthyroidism. ARTHUR C. CHRISTIE, M. D., Pennsylvania J. Roentgenol. 4:1-6, October, 1923.

THE POINTS of diagnosis are first considered and treatment by rest, diet, surgery and roentgen ray is then discussed. Of surgical treatment he says it is fair to conclude that it cures about 75 per cent of cases operated upon and that the operative mortality is at least 3.5 per cent, and that the percentage of inoperable cases is not known.

Of roentgen ray treatment he says that he believes the results are about equal to those of surgery but that sufficient time has not yet elapsed to prove this. Surgical statistics will always have an advantage over those of the roentgenologist because the latter reports all cases that come to him while the surgeon's report is upon those operated.

The roentgenologist who treats hyperthyroidism should take a broad view of his responsibilities. "He may do more harm than good by simply giving a certain dose of roentgen rays at stated intervals without regard to the patient's general symptoms, the conditions under which he is living and working, and his changing metabolic rate. If the general management is under the care of an internist.....the roentgenologist must assure himself that such treatment is being properly carried out." In one case the author found that a patient who was being treated by the rays was taking thyroid tablets at the direction of the physician. The basal metabolic rate must be carefully watched. It should be taken at least once before treatment, sometimes two or three times before treatment, and about ten days after the third treatment to serve as a guide for succeeding ones.

X-Ray Therapy of the Thyroid Gland. JOHN A. WILLIAMS, M. D., New York M. J. and M. R. 118:480-482, Oct. 17, 1923.

THE LITERATURE upon this subject is reviewed, some twenty or more noted workers' general conclusions and ideas being given.

The author believes that all cases of hyperthyroidism should be treated with rest and x-ray therapy and that cases not cured are better surgical risks after x-ray treatment. X-ray is indicated in cases where symptoms persist after surgery. In malignant disease of the thyroid, surgery is indicated where removal of the growth seems possible. Prophylactic postoperative radiation should be given. If inoperable, relief may follow intensive x-ray treatment of the case, and there is a possibility of cure in such cases.

Physiotherapy in Medicine. EDITORIAL, Rhode Island M. J., 6:188, December, 1923.

PHYSIOTHERAPY'S worst enemies are its friends who have showered such enthusiastic encomiums upon it that one naturally mistrusts their judgment. "What we need and need sorely is the knowledge as to when and how and precisely in what morbid conditions we may with benefit resort to the various modes of physiotherapy." "What is lacking in much of our physiotherapy is the scientific spirit, the attitude of mind which verifies hypotheses and brings general principles to the test of properly controlled experiments." Meanwhile, says the author, much may be learned from the critical evaluation of experience.

Physicians by reason of training and tradition are conservative and not given to invoking strange gods. "But conservatism has dangers of its own, not the least of which is the tendency to cling to the old ways of doing things—a tendency which by very reason of its respectability and prestige, is likely to conceal its closeness to obscurantism. Every new idea, every original or novel method of treatment has to fight its way to acceptance. And as in the past, so in the present, this process is going on, with the result that we observe physiotherapy struggling to gain for itself a place in the hierarchy of medical orthodoxy."

Diverse forces of nature such as plants and animals have for centuries rendered aid to the physicians, why not then, heat, light, water and electricity. "We do but strain at a gnat and swallow a camel when we look askance at these latter because they have been too often used by charlatans and quacks, for who but a peasant woman in Shropshire gave us digitalis, and did not the Indian introduce us to quinine, while if we are fastidious, we shall not inquire too minutely about the company mercury has kept. There is wisdom in the remark of Aristotle that it is not things in themselves but the use to which they are put which ennoble or degrade. If we physicians do not elevate physiotherapy, as we have tried to elevate drug therapy and psychotherapy, then it is certain that irregular practitioners will continue to exploit and degrade it."

Physiotherapy. NORMAN E. TITUS, M. D., New York M. J. & M. R. 118:1-4, July 4, 1923.

COOPERATION, not supercession should be the physiotherapist's aim—and this is the aim of the medical physiotherapist for he recognizes that the accepted operating room, laboratory and ward treatment should be used whenever indicated and that physiotherapy is an aid to these methods of treatment. Inadequate body reaction may often be transformed into adequate reaction by means of physiotherapy. The special divisions of physiotherapy are electrotherapy, phototherapy, thermotherapy, hydrotherapy, actinotherapy, roentgenotherapy, massage and exercise.

Electrotherapy has four modalities: *Galvanic electricity* is a current flowing in one direction and having a definite positive and negative pole. The positive pole has analgesic hemostatic and antiseptic actions, repelling bases, metals and alkaloids. The negative pole has the opposite characteristics and repels acids and acid radicals. It is often used to soften scar tissue and to loosen adherent scars. It may be used to remove hair but this is a delicate procedure. *The faradic current is* a pure induced current without either pole and its greatest use is to produce exercise of the muscles through the stimulation of the motor end-plates. *High frequency currents* have no definite positive and negative pole as they are of alternating character and of such great frequency in alternation that their entire effect is due to their ability to generate heat when passing through such resistance as the body offers. *The static current* is the fourth modality and has high voltage and low amperage, i. e., great force with

small volume and its forms are the static wave current, the spark discharge and the static brush discharge. It is purely mechanical but far surpasses massage in its effects for it "makes the part work instead of working the part."

The two forms of the high frequency current are the d'Arsonval and the Oudin current. The d'Arsonval is applied with two electrodes and the Oudin applied with one.

The d'Arsonval current is used for autocondensation or condensing the current in the patient's body, producing an actual rise of temperature and whipping up all bodily processes. It is used to reduce blood pressure. In 25 cases of high blood pressure the author has met with an average drop of 14 mm. in each treatment and in 48 hours the pressure does not rise more than 35 or 40 per cent of the amount reduced. The second use to which this current is put is called diathermy (medical or surgical). In medical diathermy good results have been secured in bronchitis and in pneumonia and also in postapoplectic paralysis to hasten absorption of the clot.

The Oudin current is applied with one pole and its chief use is to destroy surface growths.

Phototherapy is treatment by means of light and is used for the heat effect which results from the light waves being stopped.

Thermotherapy is the use of dry heat from electric bakers, into which a portion or all of the body may be placed.

Actinotherapy is treatment by ultraviolet light. It is germicidal and tonic in its effect and is more efficient than is sunlight because its wave-lengths are much shorter than are those of sunlight. In superficial infections of the skin or in subacute infections of wounds ultraviolet is a distinct aid. The air cooled lamp has no greater penetration than 1 mm. but the water cooled has a penetration of one-tenth of an inch or, if the applicator is such that it can be placed upon the skin, it has a penetration of a quarter of an inch. In the Leonard Research Prize Contest of the American Roentgen Ray Society honorable mention was made in 1922 of the work of Major C. M. Sampson, who has used ultraviolet light to increase the skin's resistance to x-ray treatment. He has been successful also in the treatment of x-ray burns by means of ultraviolet light.

Hydrotherapy is superficial in its direct action and is an indirect means of producing a sedative or an intensely stimulating secondary reaction in the body or parts to which it may be applied.

Roentgenotherapy is too broad a subject, the author says, to be discussed in such a paper as this. He says that overenthusiasm has done harm to its reputation but that it has proved itself in some fields and is making great advances. He would not use it in tonsil treatment except in cases where surgery is contra-indicated.

Massage has its place, but in acute conditions electricity is better.

Exercise is much used in re-education.

Physical Therapy. JOHN H. BURCH, M. D. New York M. J. & M. R. 118:4-8, July 4, 1923.

IT REQUIRES some temerity, says this author, to present a paper on physical therapeutics. He says:

"The suggestive effect of the various electric machines emitting weird lights and scattering sparks was readily made use of by shrewd charlatans to extort money from their credulous victims. The semi-quacks within the medical profession also exploited the various methods of physical therapy to the extent that the honest physician became unduly prejudiced against all forms of electrical and mechanical methods of treatment.

"The profession is beginning to inquire just what type of cases may be benefited by the various electrical, mechanical and phototherapeutic methods of treatment. No little surprise and chagrin are manifested when a patient reports that he has been cured by an osteopath, a chiropractor or an advertising quack who makes use of physical methods of treatment. Many reputable physicians refer their patients to osteopaths, the barber who installs electrical equipment, or the hospital technician, rather than perfect themselves in these methods of treatment or to confer with their confreres who have diligently sought to sift the few grains of truth from the great bulk of the chaff regarding the effects of these natural methods made use of in medicine and surgery."

Phototherapy is first discussed and the author states that it is beneficial in the treatment of acute painful conditions such as neuritis, etc., and in hastening the absorption of serous exudates in joints and in pleural and peritoneal cavities. It is useful in lupus. Chronic dry eczema and acne vulgaris has been successfully treated by this author by a high power incandescent light.

Mechanical vibration is the subject of an interesting page of discussion, thus summed up: ".....it will be seen that vibratory stimulation or inhibition applied over the posterior branches of the spinal nerves will, through their ganglionic connection with structures and viscera, produce marked functional and metabolic reactions. My experience has taught me that it is in functional abnormalities that this method is of the greatest value. The danger of this system of therapy lies in the ignorance of the cults who practice it in attempting not only to treat all manner of ailments by this method but also in basing a system of diagnosis upon apparent spinal abnormalities." These so-called abnormalities, he has previouslyly said, while they may at times occur, are oftener than not apparent and not real.

The various types of electric treatment as given in the abstract from Dr. Titus' paper are discussed here also.

The Problem of the Physiotherapy Aide. A. B. HIRSCH, M. D. Chief of Physiotherapy Department, U. S. Veterans' Bureau, and EMILY WELLINGTON, Chief Aide, Physiotherapy Clinic, Grand Central Palace. New York M. J. & M. Rec. 118:8-10, July 4, 1923.

THE FULLY trained physiotherapy aide is an essential in present day medical practice. Training should include academic study followed by a course in physical education preliminary to a course in physiotherapy. These two courses should be given under medical direction. Treatments given by the aide should be prescribed by the physician, who is fully trained in these methods, and the aide's technique should be frequently inspected by him. There is at present no institution where a course in physiotherapy is a part of the medical curriculum. Several leading physicians who are specialists in physiotherapy give instruction in their clinics and Harvard University offers a six weeks summer course in postgraduate instruction to aides. Hospitals must ultimately provide for such training.

The Physiotherapy Clinic.—A Necessity for the Modern Hospital. RICHARD KOVACS, M. D. New York M. J. & M. Rec. 118:10-13, July 4, 1923.

THE HISTORY of military hospitals shows that the return of men to the service was 30 per cent greater in those hospitals having a physiotherapy department than in those without one. For an economic

reason alone, if for no other, physiotherapy is a specialty bound to succeed. The great industrial houses have seen that it is profitable and an advantage to them to have such departments in their own institutions.

The equipment for a modern physiotherapy clinic should include the modalities of electrotherapy such as static, high frequency, galvanic, faradic, sinusoidal currents, ultraviolet and x-rays; massage, active and passive motions, and therapeutic exercises, whirlpool baths, showers, Scotch douches, electric light cabinets and a full set of radiant light and heat applicators. The equipment is expensive but the machinery will last for many years and the demand is such that the department will be self-sustaining. "There is already a deplorable tendency in some quarters to capitalize the readiness of patients to pay for physiotherapy treatments. It will work a discredit to physiotherapy if perfunctory rubbings are substituted for real massage, five minute light treatments for real heat and light therapy, and a few minutes play from a cheap high frequency box for real electrotherapy."

The director should have had the experience gained from general practice besides his knowledge and training in physiotherapy. Assistants and aides should be adequately trained.

The author has found physiotherapy valuable in fractures and the disabilities arising therefrom, in fibrous ankylosis of the joints, in scoliosis, freeing of adherent scars and in nerve injuries. In osteomyelitis it is of well known value. There are many border-line cases between medicine and surgery where the relief by properly applied physiotherapy is marked.

Ultraviolet Rays. PROF. LUIGI ARNONE, Florence Italy. Dental Cosmos, 65:1027-1036, October, 1923.

QUARTZ LAMPS, in general, do not represent the most efficient appliances for therapeutic purposes in connection with ultraviolet rays. The fundamental drawback to all of them is the defect of the light itself. The light may be more or less intense but lacks in penetrating qualities, due to the almost total absence of red and infra-red rays. The rays from mercury vapor lamps are only efficacious on the surface of the tissues. In dermatology, however, these lamps give ultraviolet rays sufficient for healing purposes, and if due precautions are taken against the caustic (yellow) rays there is no objection to their use in dermatological conditions. Dentists, however, deal with deeper tissues and before the rays can reach the bone they must travel through tissues which act as a barricade. The red blood corpuscles effect a complete barrage. It is necessary then for dental therapeutics that the source of the ultraviolet rays should yield infra-red penetrating rays as well as the ultraviolet rays. Such a light is the voltaic arc-light given out between two carbon points in a state of incandescence. This light emits the whole gamut of rays found in sunshine and is very rich in ultraviolet rays and in infra-red rays. Also by incorporations of radio-active elements and of metallic oxids in the carbons, the quota may be done away with. The arc-light is a miniature sun which may be controlled and modified to suit one's requirements.

The author's figure to illustrate the nature of the ultraviolet rays is an interesting bit of imagination. The ultraviolet waves "are simply waves or undulations, like the waves formed on a quiet pond into which a stone is thrown. The ether. . . . is our pond of water: electrons are our stones; electricity is the arm which wields the stone." Also he adds that light waves, magnetic waves and electric waves are but different manifestations of a single, transcendental force which Einstein has lately identified as the universal force, gravitation. One-quarter of the total energy of the sun reaches us in the form of ultraviolet rays.

The author elaborates at considerable length what he has here said about the arc-light in contrast with the deficient spectrum of the quartz lamp, seeming to prove his point. He says that his experience has taught him that the arc-light never disappoints the user.

He recommends the ultraviolet rays for ulcerating surfaces of all kinds except those due to syphilis, which cannot be so cured. "Dental abscesses, however deep seated, chronic gingivitis, pyorrhea alveolaris, periosteal or periodontal trouble, neuralgia along the course of the trigeminus, are all amenable to this treatment." Used after a painful or difficult extraction of teeth they will allay the pain as though by magic and will hasten the healing process. He cites an obstinate case of vitiligo cured after twenty sittings. Furunculosis, eczema of nose and ear are also cured by the rays, and finally as a general treatment for nervous fatigue the rays are highly recommended.

Black Body Radiations and Their Therapeutic Possibilities. CHARLES F. STOKES, M. D., Am. J. Electroth. & Radiol. 41:351-360, November, 1923.

BAYLISS is quoted as saying: "It looks as if, before long, we shall not be contented with the statement that such and such a particular phenomenon is chemical but demand an explanation in terms of the physics of the atom." The physical agents employed in therapeutics owe their effectiveness in a large measure to their action upon valency electrons. Reference is here made to the specific and selective effects of the various forms of radiant energy classified according to their wave lengths and the infra-red rays of the longer wave-lengths are the real subject of this paper. In summary the author says that they "are active where they are absorbed. They vibrate molecules, atoms and electrons with heating effects, increased oxidation, increased conductivity, relief of stasis and they induce arterial blood hyperemia. In mild sedative doses they are analgesic. They are rejuvenative. They will probably replace diathermy in some techniques. They are free from harmful effects."

How to Avoid Losing Radium. Pennsylvania J. Roentgenol. 1:27, October, 1923. Quoted from "Radium," Volume II.

WHEN NOT in use keep the radium in one specified place in the same safe each time. Each time of removal make a notation as to day, hour and by whom removed, also same data as to return. There should be actual checking at these times to be sure that no empty screens are checked in or out. In addition there should be a regular daily check to see that all tubes, needles, etc., are on hand. All dressings, sweepings and waste paper should be held twenty-four hours until the individual responsible for checking the radium in and out each day has ascertained that no radium is missing. Patients upon whom radium has been placed should not be permitted to move about the hospital but should remain in one place and their bed or person should bear a placard warning against removing or destroying dressings.

A device for additional safety consists of a length of piano wire, two or three feet long, to one end of which the radium is attached and to the other end a brass ring is fastened which can be attached by

adhesive or some other means to the patient in such a way as not to cause discomfort. The radium is only removed when wanted as a part of another applicator, to which a wire has been attached. This serves as protection in case of negligence in checking in or out. The personal equation must always be reckoned with. If there should be such misfortune as the radium being carried to the incinerator it can of course be salvaged.

Three Years' Experience with Radium. HOWARD KING, M. D., J. Tenn. M. A. 16:292-296, December, 1923

THE author's observations during three years experience are summed up in the following: "Radium has its greatest value in the treatment of (a) carcinoma of the cervix, (b) uterine bleeders with or without tumors, (c) other mucous membrane malignancies in the following order, mouth, rectum and vagina, (d) superficial malignancies, (e) angiomata, (f) benign excrescences such as warts, nevi, keloids, etc.

"Needle implantation is superior to surface application. Malignant cases receiving one uniformly heavy dose do better than those receiving repeated light dosage. Some malignant cases that seem hopeless at first respond wonderfully. This is especially true in older individuals. Rectal cases should have a permanent colostomy in order to give sufficient radiation without causing distressing symptoms. Indications are that results of much greater promise will be obtained by the aid of deep x-ray therapy."

Cranial Radiography. ROBERT KNOX, M. D., Arch. Radiol. & Electroth. 28:161-183, November, 1923.

THIS lengthy but compact paper must be studied in connection with its illustrations and its great wealth of detail in order to be of practical value. The history and technique of the radiology of the sella turcica are given and the apparatus used is described. A copy of this number of the Archives would be of value to anyone interested, as the article occupies almost the entire issue. A further abstract would not be of practical use owing to the reasons given.

Bone Malignancy. MAX KAHN, M. D. Pennsylvania J. Roentgenol. 4:11-13, October, 1923.

DIAGNOSIS of bone malignancy is dependent upon the roentgen ray examination, history of the case, physical examination and blood examination, and a study of the urine for Bence-Jones bodies.

All bones and joints which have been subjected to trauma, likewise all bones and joints giving pain, should be examined for traces of malignancy, not only once but a second time later on. In bone malignancy there is very frequently a history of trauma at the site of the malignancy. Changes from the normal are slight at the beginning and examination should be made from time to time as the case progresses. The opposite side should be examined at least once for the sake of comparison.

Bone malignancy is classified by the author as either sarcoma or metastasis from a primary growth, and reference is made to Bloodgood's classification of sarcomas given in the April 1923 issue of the Journal. Metastasis may be secondary to almost any type of carcinoma. Bone sarcoma may be either primary or metastatic.

One cannot always tell from the roentgenogram just what type of malignancy is present and the most that one can usually say is that he is dealing with a malignancy.

Metastasis to the lungs is frequent in all types of bone sarcoma and it is manifested by rounded circumscribed shadows varying in size from that of a pinhead to that of an orange. Early metastasis is difficult of detection but it is not difficult to detect it in later cases.

Treatment of malignant bone neoplasm is dependent upon surgery, roentgen ray, radium and Coley's serum. Both roentgen rays and radium will relieve pain but there are few recorded cases of cures lasting over three years. Better results might follow were cases detected early. Deep roentgen ray is better treatment than is radium. Coley reports some cases of apparent cure three years after treatment with his serum.

A Rare Malignant Tumor of the Radius. H. Q. GALLUPE, M. D. Boston M. & S. J. 189:919-925, Dec. 6, 1923.

THIS CASE occurred in a young woman whose chief complaint was pain in the left wrist. There was no history of injury. Examination showed some swelling with tenderness at the lower end of the left radius. A temporary diagnosis of tubercular abscess was made and after an x-ray examination was made the diagnosis was that of either tuberculosis or chronic osteomyelitis. About a month after the patient first entered the clinic, a specimen of the tumor was obtained for microscopic examination and a diagnosis of malignant endothelioma was made. During the next seven months nine x-ray treatments were given and three months later an advance in the process was noted. It was then decided to amputate the arm above the elbow. This was done and the tumor was found to be about two centimeters long and one wide, was a firm reddish mass in and beneath the periosteum. Microscopic examination showed that the growth had invaded the surrounding bone tissue and had destroyed much of it, also it had grown through the shaft and invaded the soft parts, i. e., fibrous and fatty tissue and muscle, in one place. A year after operation the patient showed no signs of metastasis anywhere.

Treatment of Cancer of the Uterus. CHARLES W. MOOTS, M. D., Ohio State M. J., 20:10-12, January, 1924.

ALL CASES of cancer of the fundus of the uterus are surgical, says this author and they "should have a complete hysterectomy with or without bilateral salpingo-oophorectomy as indicated. The use of some cautery technique, such as Werder suggested, is probably an additional protection.

"Surgery should also be chosen in the very early cases of cancer of the cervix, provided the disease is confined within the same.

"Irradiation is the agent of choice when the disease is not confined within the uterus. Radium or its emanations, for cases permitting applications close to the disease, and x-ray for those needing deeper action" is recommended and radium is also recommended as an adjunct to radium treatment in many cases.

"Nothing is to be gained by postoperative applications of radium, but deep x-ray treatments probably offer additional security. Cases that have done well under irradiations will probably not be benefited by surgery. Early treatment is the most important factor."

Cancer of the Breast: Biological Considerations in Radiotherapy. M. J. SITTENFIELD, M. D., New York M. J. & M. R, 118:487-490, Oct. 17, 1923.

THE AUTHOR says that even with accurate physical dosing, failure follows too frequently. "For one reason the biological dose for tumors is not a constant, and for another,

greater and perhaps more important factors play their part in the absorption co-efficient. In spite of our best efforts in technique to kill the tumor growth by efficient radiation and in the face of possible determination of a lethal dose for cancer, only too often are we helpless to cope with the disease. Now the question arises how are we to reconcile these two inconsistent conditions. Our shortcomings must be explained essentially on the basis that not sufficient thought has been given to this phase of the question. In the first place we are constantly speaking of a mixed or heterogeneous beam of rays as a physicochemical agent, and perhaps this would serve our purpose if the tissue or cancer cell were purely a physicochemical reagent, on the one hand to act, and on the other to react. But experimentally we know that this reaction can take place only if an interaction ensues, and in this case it means that the cell must absorb the ray. Perhaps variations in the ability or the inability to take up or absorb the ray may account for the differences in the ray absorption of the cancer cells. After all is said, it is not the amount of radiation administered that provokes the response, but the amount of ray absorbability or radiosensitiveness of the tissue that is responsible for the reaction, and this radiosensitiveness differs in the different tissues, though every tissue reacts to radiation in a varied degree, from the most radiasensitive tissues to the nerve tissue, which is perhaps the least radiosensitive. This lack of absorptive power of a given carcinoma tissue may possibly explain our failure in spite of our most earnest efforts."

Further on in his paper he says: "The reaction from x-ray in a carcinoma may not depend only upon the intracellular change in the tumor itself but also upon the effects of the rays upon various processes in the normal tissue, though this much seems to be established, that we are not aware at present of any chemical or physical agent that can influence diseased tissue and leave the normal tissue intact. In other words, it is necessary that advances in pathological knowledge keep pace with the improvement in newer technique, and that both of them be put into practical purposes.

"The sum total of present day roentgenotherapy denotes that we are just in the developmental stage of wave therapy, the surface of which has but been scratched, and as a result we begin to see a little light, though it promises a great deal and many possibilities are in store. The future of radiation therapy of cancer would seem to depend upon a knowledge of the varied response, either direct or indirect, of the tissue to the varied amounts of radiation. This would make for an ideal biological and clinical reactivity, inasmuch as it would offer a measurement of the radiosensibility of a given carcinoma."

The author believes that the good results reported in some clinics abroad may perhaps be due to a greater care regarding the general condition of the patient after radiation, to the use of intravenous injections of arsenic, iodine, etc. Too frequently he says that in attempts to deal with cancer itself all sense of proportion is lost sight of with regard to the patient. The physical state and the power to react to intensive radiation, cachexia and other constitutional disorders should be taken into consideration.

The Prevention of Cancer. ADAM H. WRIGHT, B. A., M. D., Public Health Jour. 14:501-505, November, 1923.

IT IS THOUGHT by the author that internal cancers are to some extent preventable by careful attention to supposedly simple, although very complex, disorders of the alimentary tract. Arbuthnot Lane and A. C. Jordon are prominent workers whom he quotes in support of his belief. It has not been their experience that cancer of the stomach comes as a bolt from the blue but that there is always a history of some disturbance of long duration. The author and other men whom he cites have found this equally true in their experience of cancer. For a period of thirty-five years the author has sought to prevent cancer by (1) prevention of faulty diet; (2) treating early symptoms of indigestion; (3) preventing intestinal stasis; (4) treating intestinal stasis as early as possible. "It is easy to give these simple directions but often a difficult task to carry them out efficiently .....Fortunately all efforts in the direction indicated will do some good; they cannot in the least degree be harmful. Moreover I can say with confidence that I believe they will, in a large proportion of cases, prevent the worst of modern scourges—cancer, and also it happens fortunately, other serious diseases."

The Occurrence of Two Heritable Types of Abnormality Among the Descendants of X-Rayed Mice. C. C. LITTLE, Sc. D. and H. J. BAGG, Ph. D., Am. J. Roentgenol. 10: 975-987, December, 1923.

THE MICE used in this study were sufficiently inbred to have given opportunity for any latent defect to have shown itself and it is therefore concluded that failure of such abnormality to appear before irradiation (also in the controls), is sufficient proof that such abnormalities as did appear after raying were due to the effects of the rays. The authors sum up their study thus:

"Abnormalities of the eyes and feet have first appeared among the second and third generation descendants of mice which, as adults, had been given one-fifth of a human erythemal dose of x-rays on each of five successive days. The first young were obtained from treated animals as late as ten weeks after their treatment, thus insuring no *in utero* effects. The eye abnormality is inherited as a mendelian recessive character. The foot abnormality is also inherited, but as yet the exact nature of its inheritance has not been worked out. The fact of the appearance of these abnormalities, the clear lesion involved in their somatic expression, their absence from the control animals, and the work of others who have used the physical agents lead us to believe that the x-ray treatment has had a causative effect upon their production. This effect appears to be of the nature of a direct effect on the germ cells themselves, not through the soma as an acquired character. The experiments here recorded justify, we believe, the recommendation of extreme caution in the use of radium or x-ray therapy on human individuals who are likely ever to serve as parents after they have been treated. This caution should be practiced until the whole matter of the effect of x-rays and raduim on the germ plasm has been much further investigated than at present."

Studies on the Biological Effects of X-Rays. JAMES W. MAVOR, M. D. Am. J. Roentgenol, 10:968-974, December, 1923.

THE BIOLOGICAL effects of the x-rays have been studied, heretofore, largely by the methods of the histologist and the pathologist. Now, however, the recent advances in the study of heredity have placed a new tool in the hands of the student of cellular physiology, enabling him to investigate the more delicate functions of cell parts instead of the grosser study to which he heretofore was limited. The experimental work

here related was conducted upon fruit flies which were x-rayed, using a Coolidge tube with a tungsten target. The water was cooled in most cases and the voltage was always 50,000, the rays being used without a filter for the most part. The current varied from a maximum of 50 ma. to a minimum of 1 ma. and the distance varied from 6.5 cm. to 70 cm. and the time from three minutes to twenty hours. The summary by the author fallows:

"1. A curve showing the variation of susceptibility to x-rays with age in the fruit fly, Drosophila, has been obtained. This curve shows a sudden decrease in susceptibility during the latter part of metamorphosis, that is, after the main structure of the adult fly has been laid down. 2. The sterilizing dose of x-rays is small compared to the lethal dose for the adult fly. A dose can be found which gives temporary sterilization. In this case the mature eggs are still fertile, the sterile period beginning after their deposition. 3. The experiments show that the x-ray treatment affects the distribution of the chromosomes during the maturation of the egg, and that such eggs, although their structure has been altered by the x-rays may nevertheless develop into adult flies and produce offspring. 4. The effect of the x-rays, consisting in an irregular distribution of the chromosomes, is inherited. 5. X-rays may cause a modification in the interchange of hereditary determiners between chromosomes. The effect of the same dose is not the same in each of the pairs of chromosomes nor in the different parts of any one pair of chromosomes. In the first or x-chromosomes, the amount of interchange is decreased, while in the second pair of chromosomes it is increased. 6. The effect of x-rays on the interchange of hereditary determiners is not directly on the process of interchange but on the chromosomes or the protoplasm surrounding them. 7. The duration of the x-ray treatment for the modification of the interchange of hereditary characters is immaterial provided the product (intensity times time), is kept constant. 8. Reasons are given for considering that certain of the effects of x-rays on the mechanism of inheritance are specific."

The Roentgenologist and the Referring Physician: Their Relationship. J. EDWARD HARRIS, M. D., W. Virginia M. J. 18:295-298, December, 1923.

ALL MEDICAL ethics is founded upon the principle that one gentleman deserves gentlemanly treatment from another one.

The roentgenologist's position among specialists is unique in that he deals with his patient only through the referring physician. Even though the patient present himself voluntarily for examination, courtesy and the interests of science demand that the last known attendant should receive whatever information the examination may yield.

The examination should never be made unless there is the possibility of real value in making it. A few men are doing the specialty harm by making needless examinations. Efficiency and not commercialism should be the watchword. Those men who buy x-ray machines "to hold my patients" are the offenders the author has in mind. The roentgenologist worthy of the name must have a minute knowledge of anatomy, histology and pathology, otherwise his interpretations will work harm and injury both to patients and to the specialty of roentgenology.

The referring physician "back home" should have a square deal and should be able to feel that his patient also will have not only scientific treatment but conscientious treatment. The roentgenologist has no right to suggest a line of treatmen to the patient without first conferring with the referring physician. On the other hand the latter owes it to the roentgenologist to treat him in the same way. Should the roentgen diagnosis be at variance with the referring physician's views he should never by word or deed reveal this to the patient until he has conferred first with the roentgenologist.

Often the referring physician is too impatient of delay in receiving roentgen diagnosis. Not being familiar with the difficulties he is apt to feel that delay is unnecessary when, in truth, painstaking procedure is rendering as rapid service as possible.

The roentgenologist if he is a true man of science will share the referring physician's eagerness, at times anxiety, as to findings in any particular case. And on the other hand, again, the referring pnysician owes it to the roentgenologist to acquaint himself with the x-ray and its uses. Too often he has only very vague ideas upon the subject.

The Present Status of the Cancer Problem. J. L. CAMPBELL, M. D. F. A. C. S., Jour. M. A., Georgia, 12:1791430, December, 1923.

THE AUTHOR, "owing to the chaotic feeling that seems to exist among men of large experience" regarding cancer treatment, wrote to Mr. Osborn, the Executive Secretary of the American Society for the Control of Cancer and asked him a series of questions, the substance of his replies being quoted as follows: "After having read, heard and lived with the subject for the past three and one-half years, I have come to the conclusion that all that is claimed for radiation may eventually be attained, but at the present time the results supported by five year cure statistics, do not justify the claims made by enthusiasts of x-ray and radium. If I had a cancer of my lip or mouth I would have it removed by the best surgeon I could find, and, if he thought best, a complete dissection of the lymphatic drainage area, and radiation, preferably by x-ray, applied later. If a member of my family had cancer of the mammary gland, I would have it treated surgically, with intensive postoperative x-ray radiation. Statistical evidence regarding cancer of the uterine cervix is so at variance that it is difficult to determine what method to adivse, but it seems that in the hands of a skillful radiologist radium would be the method of choice."

The author himself considers radium the best method of treatment for small basal cell epitheliomas of the face and neck. For any lesion about the lips, tongue or mouth he would do a complete removal by excision or by cautery, with a block dissection of the neck and postoperative x-ray radiation. Radium here may temporarily cure the local lesion but is apt to be followed by metastases in the submaxillary nodes. Early diagnosis, a radical operation followed by intensive x-ray radiation offers the best method of treatment. Surgery offers the only hope in cancer of the digestive tract but as a rule this lesion is discovered so late that it is hopeless.

Malignant Disease and Its Treatment by X-Rays, Radium and Electrocoagulation. GEORGE E. PFAHLER, M. D., Northwest Med. 22:432-436, December, 1923.

FEAR of an operation leads to much delay in the treatment of cancer and therefore other hopes of cure should be held out to the laity when possible. All precancerous lesions and practically all skin cancers can be successfully treated with electrocoagulation and radiation. Epithelioma of the lip should be so

treated as early as possible using local destructive methods by electrocoagulation and radiating the adjacent lymphatics. Carcinoma of the breast should be radiated both before the operation and after it. Cooperation among the family physician, surgeon and radiologist will accomplish the most for the patient. Carcinoma of the uterus, the author believes, is best treated by thorough radiation with radium and with high voltage x-rays, "carefully used."

Skill in radiology, thorough knowledge of pathology and clinical medicine, and a knowledge of the principles of physics are necessary for the best success.

An Appraisal of the Newer Methods of Deep Roentgen Therapy. JAMES T. CASE, M. D., New York M. J. & M. R. 118:368-372, Sept. 19, 1923.

SUFFICIENT time has not yet elapsed for an appraisal by five-year results for it is only about two years since the newer methods have been widely adopted. However, the results so far obtained "warrant a certain amount of pardonable enthusiasm." What is now most needed is a biological standard easily recognized by various workers and with which physical estimations may be collaborated. Conceptions as to what constitutes a skin erythema dose are too varied, a better and more constant biological standard is needed. "Faulty as it may be the familiar table of Seitz and Wintz constitutes our best guide at present writing. . . . . "

Whether to administer the carcinoma dose within the shortest time possible is a question variously answered. Seitz and Wintz administer the full treatment for pelvic cancer in three carefully planned intensive sessions at intervals of six to eight weeks. Holzknecht and Groedel, Beclere and Regaud take issue with the intensive single session, massive idea. Regaud especially would use weaker doses extending over seven to eight days. The author of this paper prefers the full dose within the shortest reasonable time considering the comfort of the patient. He trys to complete the probable carcinoma dose within four to eight days.

Postoperative irradiation should be a matter of an intensive single session treatment, one to four to five days. The author thinks that Bovee's work gives ground for believing that preoperative roentgenization diminishes the danger of transplantation of malignant tissue.

Roentgen toxemia is an unsolved problem.

The greatest danger in the new treatment is that arising from insufficient dosage, for this will stimulate the malignant cells. Severe skin reactions can be avoided. In the author's clinic the most marked blood changes occurring after irradiation are not permanent and are not a contra-indication to treatment in any but the cachectic. Intestinal disturbances may occur but these are also temporary, lasting only for a week or two. Months after treatment, varices or even ulcerations may occur in the rectum and the lower sigmoid, and vaginitis may appear even though no vaginal roentgen application has been made. Sometimes such appearances lead one to question whether recurrence is present.

Metastases are not increased by radiotherapy if this has been properly carried out.

Finally, the author would operate in operable cases and would use both pre-operative and postoperative irradiation, employing both roentgen ray and radium according to the nature of the case.

The Newer Aspects of Roentgenology. CHARLES EASTMOND, M. D., New York, M. J. & M. R. 118: 484-487, Oct. 17, 1923.

THE AUTHOR lists the diseases and conditions for which he uses the x-ray thus:

Acne: Indurated and pustular forms offer brilliant results. Simple acute acne is easily eliminated. Acne of the menstrual period is not affected by the x-ray.

Eczema: Is almost invariably relieved with complete restoration of the normal skin.

Psoriasis: Irradiation alone brings only temporary relief but irradiation plus chrysarobin is usually effective.

Folliculitis, ringworn and sycosis: The loss of hair incident to the treatment cures the condition. The hair will return in from two to three months.

Verruca vulgaris: This, the common wart, yields readily.

Keloid: If this is traumatic it is amenable to treatment, however, if it is the result of surgical trauma it is more resistant.

Lupus: If destruction of the affected tissue is the end sought the results will be good.

Rhinoscleroma: X-ray is practically a specific.

Hodgkin's disease: Treatment will prolong life from two to five years.

Tubercular glands: Radiation is the treatment of choice.

Thyroid conditions: Order of response to radiation is (1) exophthalmic, (2) toxic, (3) cystic. The roentgenologist and the physician must work together on thyroid cases.

Tonsils: End-results not yet sufficiently established. The author believes that treatment should be limited to children and to adult cases where surgery is contra-indicated.

Ovaries: Menorrhagia is controlled. The presence of a fibroid is an indication for, and not a contra-indication to, roentgen therapy.

Uterine fibroids: Except in pedunculated and intra-uterine fibroids or in the presence of a mass which can be removed with no disturbance of the uterus as a whole, surgical treatment is unwarranted during the childbearing period. The author believes that radiation has a direct action upon the growth itself and that the action upon the ovaries does not altogether account for the retrogression of the fibroid as the German school teaches. Fibroids are sometimes found present after the menopause and sometimes originate after the menopause.

Carcinoma: "High voltage roentgenotherapy in competent hands is doing more for the relief of malignancy and certain other types of tumor than any other means which has yet been placed at the disposal of the physician. Furthermore this method of treatment is effective even after surgical failure."

The Treatment of Malignant Disease by Means of the New Higher Voltage Shorter Wave-Length Roentgen Rays, Radium and Electrothermic Coagulation. J. THOMPSON STEVENS, M. D., J. M Soc. New Jersey, 20:115-120, Dec., 1923.

THE AUTHOR summarizes his paper as follows: "The determination of definite therapeutic dosages of rays required, together with the perfection of an iontoquantimeter for measuring the radiations, are the greatest achievements to date in radiation therapy.

"The 'new' higher voltage, shorter wave-length roentgen rays are a distinct step forward. They, combined with radium, permit a homogeneous radiation of any depth within the body to be given, without the dangers of the 'old' methods of damage to the nearby normal, healthy organs.

"Radium should not be used alone in the treatment of any form of malignancy that has extended beyond the skin or that lies under the skin. The best use for radium is from

within a malignant process, to bring up the local intensities to the required amounts.

"Strictly localized cases should be treated surgically, plus pre and postoperative radiation. Some definitely inoperable cases can be gotten well with radiation therapy skillfully carried out. The hopeless cases should be treated by the older methods of fractional dosage, simply for palliation. The new method, by causing rapid destruction of cancer cells, is very apt to produce a fatal cachexia, due to absorption of necrotic debris.

"When it is possible to use electrothermic coagulation, we should not hesitate to use it. It is one of our best agents to destroy malignant disease."

The Economics of Dosimetry in Radiotherapy. GIOACCHINO FAILLA, E. E., and EDITH H. QUIMBY, M. A., Am. J. Roentgenol. 944-967, December, 1923.

THE FOLLOWING is the author's summary of the paper: (1) The ionization experiments described in this paper were made with an ionization chamber fulfilling the requirements set forth by Friedrich. (2) Precautions were taken to avoid, or correct for, errors inherent in such measurements. (3) The data obtained led to the following generalizations which to our knowledge have not been made before: (a) the effect of the size of the field on the radiation effective at any particular tissue depth is the same for all filters and all distances used in practice: (b) the effect of the filter on radiation at any particular tissue depth is the same for all skin areas and all distances used in practice: (c) if all the dosage factors except the target skin distance are the same, the relative depth doses depend only on the inverse square law; (d) for purposes of skin dosage in radiotherapy, the inverse square law is applicable, provided the same beam of radiation is effective at the different distances considered. (4) An empirical equation is developed for the calculation of the amount of radiation effective at any tissue depth (including the surface), under different conditions of treatment. (5) Tables and charts of the factors involved are given. They are for a voltage of 200 kv. (crest value) and a typical American machine. (6) From the data available in the literature it is shown that these factors can be used by radiologists using machines of this type without introducing a large error in the calculations. (7) 'Efficiency charts' for a number of conditions of treatment are given. They enable the radiologist to determine the most economical filter and target-skin distance to use in giving any particular treatment. (8) The charts can be used for other purposes, such as the determination of the percentage depth dose, the number of ports of entry to use in order to obtain the desired depth dose, etc. (9) Examples are worked out illustrating the use of the equation and the charts. (10) The limits of applicability of the generalizations, the equation and the charts are definitely set forth. The data given extend only slightly beyond the ranges used in the experiments, so that no large errors are introduced by the extrapolations. We believe that no error greater than five per cent plus or minus will result from the judicious use of our data by American radiologists. (11) Results are independent of milliampere minutes."

Chronic Intestinal Stasis: A Radiological Study.

THE BOOK by Alfred C. Jordan is reviewed in the Medical Journal and Medical Record of Jan. 16, 1924.

The review comprises three columns and among other things the reviewer says: "The book is fascinating in a high degree and describes the romance of radiology as applied to the problems of intestinal stasis in a way which simplifies and clarifies the subject greatly. Of course there are many who think that chronic intestinal stasis and its effects have been greatly exaggerated .....pronounced stress throughout the book is laid upon the point that in disease there is an essential unity, if one organ is in distress the entire system is more or less involved..... Dr. Jordon has done a great service by demonstrating by pen and picture in a masterly fashion the mechanical changes produced by stasis as well as its bad influence on the general health. The volume proves up to the hilt the diagnostic value of radiology set forth by one who knows his subject from A to Z."

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